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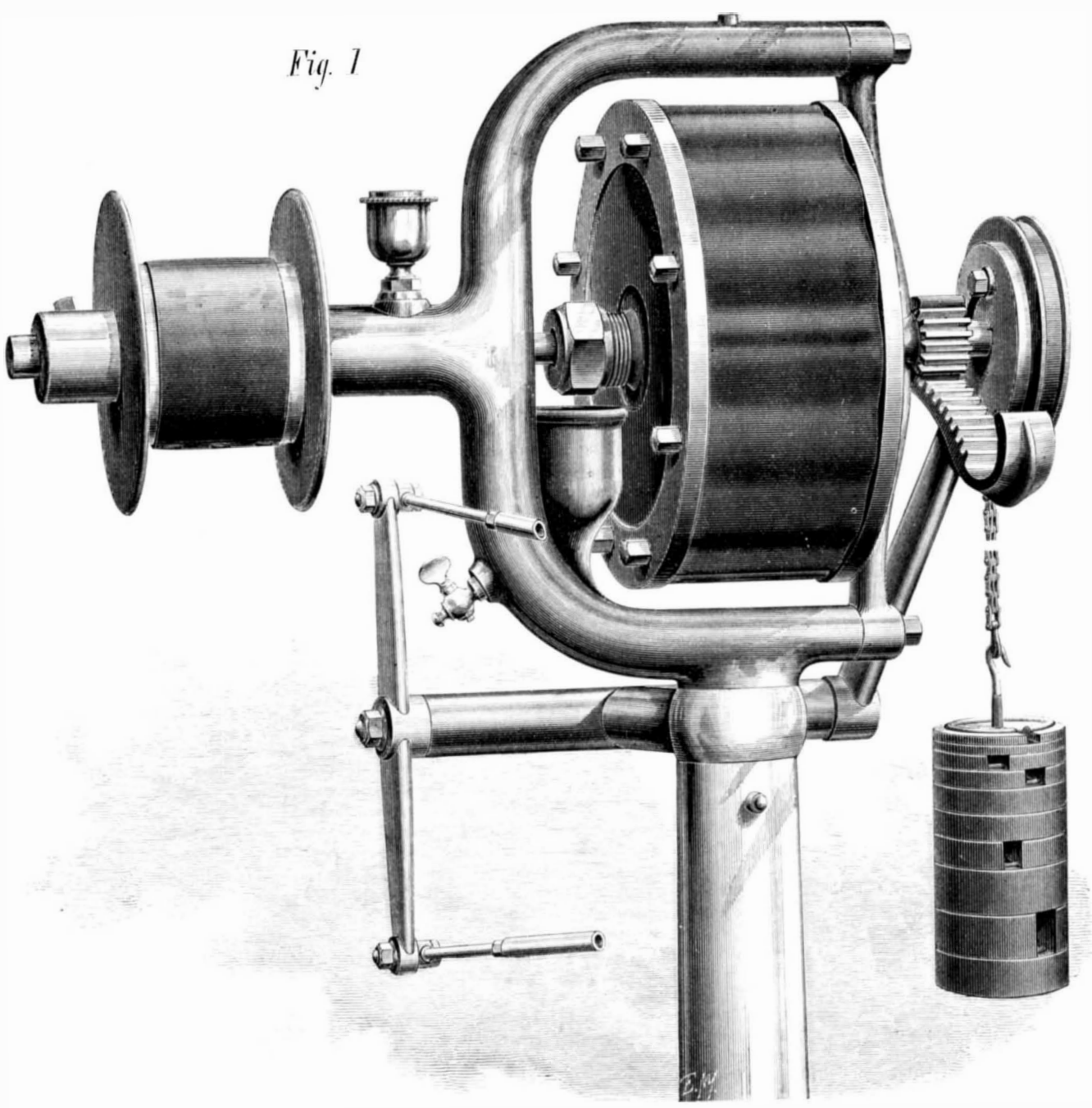
THE ALLEN GOVERNOR.

During the last fifty years, it has been the constant effort of thoughtful engineers and machinists in all the world to discover the best mode of maintaining a uniform speed in the working of steam engines while variations occur in the amount of work done by them. It is well known that machinery cannot produce its most profitable results without being run at the highest rate of speed consistent with its durability and the production of a perfect fabric, and that no machinery can be run at or near its highest rate when subjected to uncontrolled variations.

The ordinary Watt governor, though capable of effecting this object with a close approximation to accuracy when the variation in the power is confined within narrow limits, fails in maintaining the speed of the engine when sudden changes occur in the resistance to be overcome. The defect becomes of serious consequence in some cases, such as in the engines driving rolling mills in iron works, where the whole power of the engine has to be exerted suddenly while the iron is passing through the rolls, and the work then ceases, leaving only the resistance of the friction of the machinery to be overcome. The object sought for in the peculiar construction of the Allen governor is the thorough and accurate regulation of steam engines, and especially those with adjustable cut-offs.

This governor was invented by R. K. Huntoon, of Boston, well known among engineers as the inventor of the old Huntoon governor, who has given nearly thirty years' study to regulating steam engines. It is patented in this and several foreign countries, and has come largely into use. It was awarded grand gold medals, at Moscow, in 1872, at Leeds, England, and at Lyons, France, in 1872, and at Vienna, in 1873.

Fig. 1



THE ALLEN STEAM ENGINE GOVERNOR.

The construction of the Allen governor will be clearly understood from Fig. 1, which represents an elevation of the governor when complete, and Figs. 2 and 3, which show sections of the cylinder and frame. Within a corrugated cylinder, A, which has small projecting ribs on its interior periphery, and which is partially filled with oil, a paddlewheel, B, is caused to revolve by a spindle (Fig. 1) passing through one end of the cylinder, driven by a belt communicating with the fly wheel shaft.

The tendency of the revolving paddlewheel is to cause the cylinder to move in the same direction. On the opposite side of the revolving spindle is a trunnion, or short spindle, fixed to the cylinder, attached to which is a wheel, C, carrying a set of movable weights suspended by a chain, the speed of the engine being regulated by the number of weights. Attached to the wheel and keyed on the end of the short spindle is a pinion, D, revolving with the cylinder and working in a toothed sector, E, the arm of which, being fixed on the spindle of the throttle valve, opens or closes it as the oil cylinder moves with the paddle, according to the variation of load thrown on the engine. When used with the variable cut-off engine, the arm is attached direct to the cut-off, as shown in Fig. 1. For other engines, a throttling valve is combined with the governor

From the above description of the Allen governor, it will be seen that the weights are raised and lowered in a nearly vertical line, and, unlike those of other governors, remain the same at every point of their suspension. The high rate of speed used acts advantageously in making the governor very sensitive; and all parts being lubricated, it works with the smallest amount of friction. This governor, in doing its work, makes an entire circuit, passing through 360°.

The peculiar action of this governor allows the use of a valve of large area, thereby admitting to the engine cylinder a large boiler pressure at each stroke of the piston, and this produces, we are informed, excellent results when applied to old engines, in increasing their power or effecting a direct saving in fuel, or both. In running an engine with this governor, with high or low pressure of steam and with all variations of power, the throttle is opened wide in the morning and remains so until closed at night, thus relieving the engineer and giving him time for other duties. The governor valve, when the apparatus is not attached to a variable cut-off engine, is constructed with a double disk in a tubular form, and is perfectly balanced, there being no spindle as in the ordinary throttle valve, to interfere with its equilibrium. The valve is moved by means of a lever, and is opened and closed by a rocking motion of a steel spindle, which is covered with brass, insuring durability. This arrangement we shall probably illustrate in a future number. Upon the least variation from the required speed, we are informed, the governor can instantly exert, upon the valve or cut-off, all necessary force, up to a thousand pounds, if required.

Fig. 2

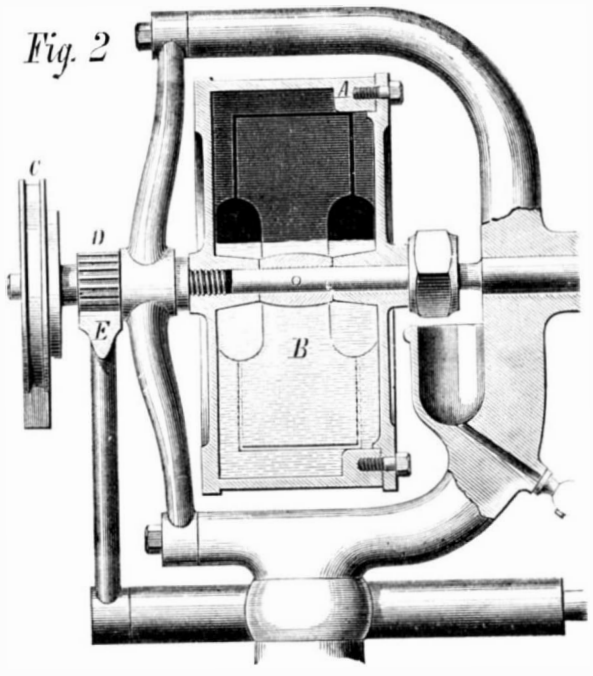
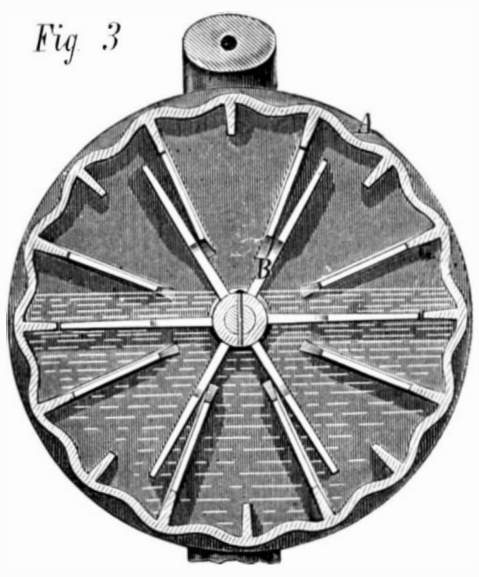


Fig 3



A large number of highly commendatory reports upon its working are submitted. Further information may be obtained by addressing the patentee, Mr. Stillman B. Allen, 5 Tremont street, Boston, Mass.

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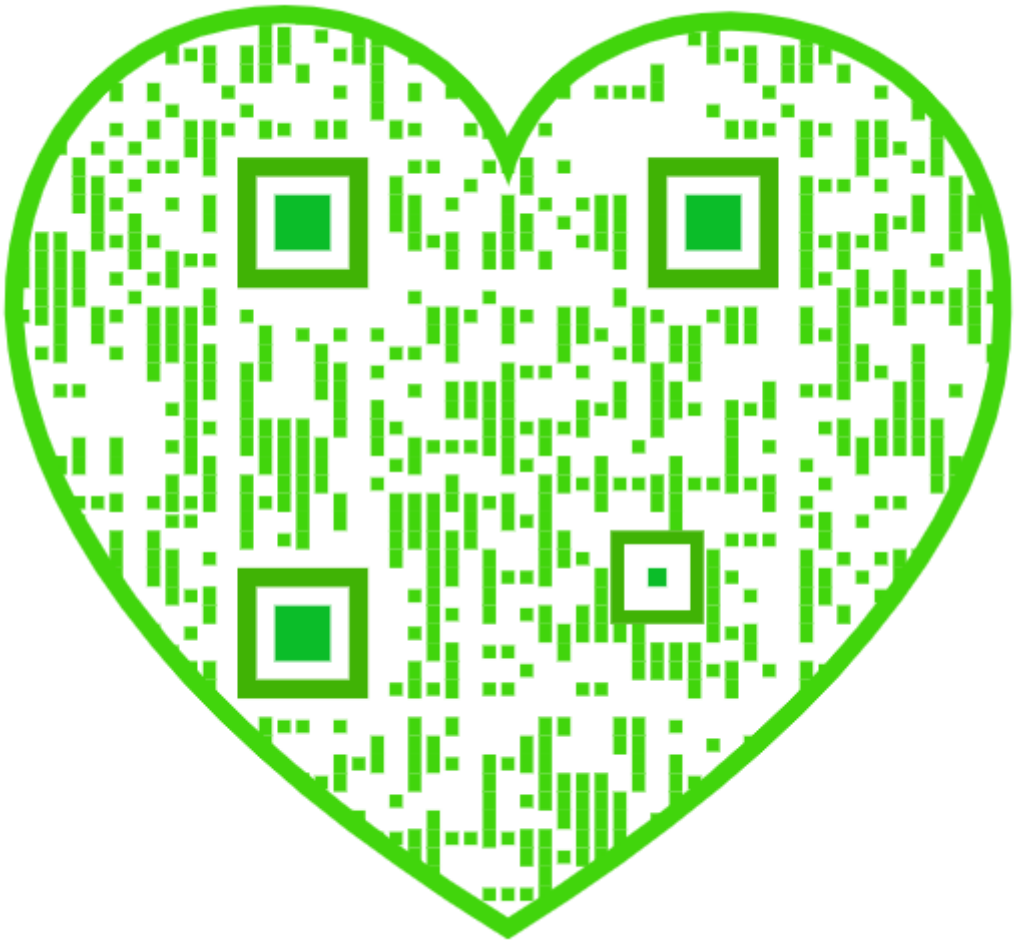

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Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, New York.. 339
Agriculture, new discovery in.... 340
American progress—1820 to 1840.... 336
Ammonia, caustic (55)..... 347
Answers to correspondents..... 346
Automata, celebrated..... 342
Balard, M..... 343
Battery carbons, etc (27)..... 346
Battery difficulties (30)..... 347
Battery solutions, bichromate (52) 347
Belts, power by (16)..... 346
Bismuth, etc., separation of..... 339
Bleaching cane (45)..... 347
Boiler details (9)..... 346
Boilers, defective, etc. (8)..... 346
Boiler sediment (71)..... 347
Boilers, hot water (25)..... 346
Boilers, plugs in (65)..... 347
Boilers, pressure in (76)..... 348
Boilers, testing (73)..... 347
Bromine, the discoverer of..... 343
Business and personal..... 346
Cancer in the mouth (62)..... 347
Caoutchouc, clear solution of (57) 347
Case-hardening iron (17)..... 346
Caspian and Black seas, the..... 340
Cement, oil-proof (47)..... 347
Centennial buildings, the.*..... 338
Centennial, French artisans at the 337
Centennial juries, the..... 340
Centennial, mechanics at the..... 337
Centennial, the opening of the.... 337
Cooper, Peter, and the locomotive 342
Dam, pressure on a (64)..... 347
Draft of a vehicle (75)..... 347
Earth's distance from the sun (23) 346
Eggshells, uses of (25)..... 346
Electric battery, Siemens' (40).... 347
Electric current breaker (37)..... 347
Electric experiment, new (38)..... 347
Electromagnets (41, 42)..... 347
Ellipse, diameters of an (11)..... 346
Ellipse, normal to an (67)..... 347
Engine, a good small (24)..... 346
Engine details (15, 19)..... 346
Engine guide bars, setting*..... 340
Engines and boilers, working (2).. 346
Engines for boats (5, 7) 346, (68).. 347
Engines, high and low pressure (69) 347
Engines, speed of (66)..... 347
Explosion, a great..... 340
Fly wheel and spring (43)..... 347
Fruit cans, hermetically sealing (55) 347
Glycerin for preserving (22)..... 346
Governor, steam engine*..... 335
Grafting wax..... 342
Grape sugar, artificial..... 342
Hall, Dr. W. W..... 339
Heating and ventilating (14)..... 346
Hydrocarbons in dynamite..... 341
Induction coils (33, 34)..... 347
Ink, glossy black (51)..... 347
Interest, calculating (4)..... 346
Inventions patented in England... 344
Japanese paper..... 339
Kerosene stains on marble (49).... 347
Lamps for rotary ovens (54)..... 347
Lever and balance (74)..... 347
Light and the color of flowers..... 340
Lightning rods (31, 32, 59)..... 347
Magneto-electric lights (28)..... 347
Magnets, remagnetizing (36)..... 347
Mercury in canned meat..... 339
Middlings separator*..... 342
Minerals..... 333
Mirrors, arranging (1)..... 346
Muslin, figures on (57)..... 347
New books and publications..... 344
New York centennial building*... 338
Nitroglycerin..... 341
Packing rings, pressure on (21).... 346
Paint, flexible oil (49)..... 347
Paint, solvent for (53)..... 347
Patent decisions, recent..... 344
Patents, American and foreign.... 345
Patents, official list of..... 348
Patents, publishing the English . 337
Peat muck for manure (10)..... 346
Petroleum, purifying (56)..... 347
Picro-hydrometer, a..... 340
Planets in perihelion (3)..... 346
Plowing a circular field (78)..... 348
Printing ink, a new..... 341
Pulleys, sizes of, etc., (20)..... 346
Radiation from a furnace (72)..... 347
Recipes, useful..... 342
Resorcin (61)..... 347
Restaurant, the South..... 338
Riveter, steam 342
Rowing gear, improved 343
Rubber and kerosene oil (50)..... 347
Rubber on boiler plates (18)..... 346
Speed of wheels, pulleys, etc..... 340
Spoke-setting machine*..... 343
Spontaneous combustion..... 343
Steppes, reclaiming the..... 337
Sulphide of carbon, purifying..... 343
Telegraph, a thread*..... 340
Telegraph, facsimile (35)..... 347
Telegraph magnets (29)..... 347
Telegraph paper, chemical (39).... 347
Telegraph in N. Y., underground. 343
Test, a new..... 339
United States centennial building* 338
Walls, division (13)..... 346
Washtub stand*..... 343
Water engines (70)..... 347
Water from clay pits, raising (26). 346
Water, hard (60)..... 347
Water, impure (12)..... 346
Waterproof varnish for fabrics (58) 347
Wells, locating (63)..... 347
Well, the deepest (77)..... 348

THE SCIENTIFIC AMERICAN SUPPLEMENT.

No. 22.

For the Week ending May 27, 1876.

TABLE OF CONTENTS.

I. THE INTERNATIONAL EXHIBITION OF 1876.—The Opening Ceremonies.—Address of the President of the United States.—Starting of the Great Engines and Machinery by the President.—Grand Procession of Distinguished Personages.—The Numbers in Attendance.—Large Map of the Grounds.—The Main Entrance and Railway Station, page engraving.—Memorial Hall, 1 engraving.—The Corliss Engines.—Gas Engines at Work.—Lawn Pavilion.—General Description of the Exhibition.

II. MECHANICS AND ENGINEERING. With 30 illustrations.—Trial of the Lay Torpedo Boat at Washington, 3 engravings.—John Fitch and his Inventions.—New Steam Street Car, 4 figures.—The French Exposition of 1878.—Mechanical Ventilation of Mines.—Setting of Gas Retorts, 8 illustrations.—Multicylinder Engine, 2 figures.—New Air Compressor, 1 engraving.—Lathe for Making Piston Rods, 9 figures.—Centrifugal Pump and Engine, 2 figures.—Improved Hydraulic Shears, 1 figure.—Bar Pit Guides.

III. TECHNOLOGY.—Preparation of Dextrine Maltose in Brewing.—Paris Green.—Unhealthy Trades, by DR. RICHARDSON.—Lead Poisons.—Aniline Vapor.—Copper Fumes.—Mercury Fumes.—Methaniline on Cotton.—Autimony Photographs.—Plate Swimming.

IV. CHEMISTRY AND METALLURGY.—Iron Assaying, by BRUNO KERL, 6 figures.—New Oxide of Sulphur.—Peroxide of Hydrogen, in Oils.—Analogy of Cyanogen to Oxygen.—DR. LETHEBY.

V. MECHANICAL DRAWING, by PROFESSOR MACCORD, 9 figures.

VI. ELECTRICITY, LIGHT, HEAT, ETC.—Velocity of Heat in Iron.—Transformation of Collodion.—Electrical Currents by Water.—Replacement of Metals in Cells.—Internal Condition of Magnets.—Action of Heat on Magnets.—Repulsion and Radiation, by PROFESSOR CROOKES.

VII. PHYSIOLOGY, MEDICINE, ETC.—Nitrogen from the Body.—Effects of Lowering Temperature.—Capillary Circulation in the Heart.—Vaso-Motor Stimulation.—Function of Succus Pyloricus.—Colors, their Effects no the Human System.—Mesmerism in Dentistry.

VIII. PROCEEDINGS OF SOCIETIES.—Academy of Sciences, Philadelphia.—French Academy of Sciences.

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AMERICAN PROGRESS---II.---FROM 1820 TO 1840.

In no era of our country's existence does it appear that greater progress was made than during the twenty years previous to 1840. Early in 1840, Dr. Richard Hare introduced the deflagrator, a form of voltaic battery capable of giving effects of great intensity, and also another form of voltaic apparatus called the calorimotor, designed to generate, with a low intensity of electricity, an enormous volume of heat. By means of it large rods of platinum can be ignited and fused in a few seconds, and its magnetic effects are equally surprising; yet it is hardly capable of producing the faintest spark between the carbon electrodes. During the same year Henry Burden invented his first cultivator, which was the beginning of a series of splendid inventions. In 1825 he received a patent for a machine for making the wrought spike, and in 1835 for a horseshoe machine. Then followed an apparatus for making the hook-headed spikes used on railways, a self-acting machine for reducing iron into blooms after puddling, another horseshoe machine, a machine for rolling iron into bars, and finally an entirely new machine for horseshoe making, which is a marvel of mechanical skill. It is self-acting, and produces, from iron bars, horseshoes at the rate of one a second. From these several inventions, Mr. Burden amassed an immense fortune. Also in about 1820, Jordan L. Mott invented the stove for burning small coal. Previously only large lumps had been devoted to domestic purposes, and the small fragments were wasted. During his lifetime he took out more than forty patents connected with coal-burning apparatus, and also instituted the change from blast furnaces to the cupola in making stoves and other light castings. His son carries on the business of his father at the present time in this city on a most extensive scale.

In 1822 James McDonald, of New York, patented an important machine for breaking and cleaning unrolled flax and hemp. During the following year, Nicholas Longworth, of Cincinnati, made his first essay in making wine from Catawba and other native grapes, thus starting the manufacture of the famous Catawba wines. At the same time another great inventor became known in the person of Joseph Saxton. In 1823, he invented the machine for giving the epicycloidal form to the teeth of notched wheels; in 1825 he made an astronomical clock, for adjusting the compensation rod in the pendulum of which he invented the reflecting pyrometer and comparator. In 1829, he went to London and there invented the magneto-electric machine. Subsequently he devised a self-registering tide gage, a deep sea thermometer, a dividing engine, and an hydraulic printing press with flexible platen.

In 1824, the Franklin Institute in Philadelphia was founded, and in the fall of the year its first annual fair was held. During the same year, Zadoc Pratt established his great tannery in Prattsville, on Schoharie Creek, N. Y., for the manufacture of hemlock-tanned leather. He probably tanned more sole leather than any man in the world, and, it is said, employed a capital of over $250,000, and continued the business till his death, without a single litigated lawsuit, or the loss of one dollar in bad debts, or having a single hide stolen. He was elected to Congress in 1836, and there proposed the introduction, through United States' consuls and national vessels, of foreign seeds and plants for distribution by the Patent Office, the publication and engraving of all important patented inventions for circulation throughout the country, and the establishment of a bureau of statistics. The year 1825 is memorable for the completion of the Erie canal, one of the greatest engineering works in the country. It connects the Hudson river with Lake Erie, is 363 miles long, and cost only about $8,000,000 to construct. Also in 1825 the first house furnace using flues was employed in Philadelphia, by Professor W. R. Johnson; and in London Jacob Perkins exhibited steam artillery, which did good experimental execution against iron targets, before the Duke of Wellington.

The first signs of the electric telegraph now become apparent; for in 1826, Harrison Dyer erected a line on Long Island and used frictional electricity to give sparks wherewith to mark chemically prepared paper. Dr. Nott, of Union College, in the same year, patented his celebrated stoves, which gave him a worldwide reputation. In 1827, John McClintic, of Pennsylvania, devised the first practical mortising and tenoning machine; and in the same year Mr. W. C. Redfield published his "Laws of Storms," wherein by long-continued observation, he showed that storms are vast whirlwinds, having both a rotary motion and a motion of translation on a curved path. Mr. Redfield's discoveries are of immense value, since they afford a knowledge of cyclones which enables navigators to avoid them. The first locomotive trip in America was made on the Carbondale and Honesdale road in Pennsylvania, in 1828. During the same year, the first American patent for a locomotive was obtained and the first straw and hay paper was made. It was in 1828 that James Bogardus invented the ring flyer for cotton spinning now in general use, and then, like Saxton and Burden, produced invention after invention with wonderful celerity. In 1829 he invented mills with eccentric grinding plates, which have never been fully superseded, in 1832 the dry gas meter, and a machine for transferring bank note plates. In 1836 he devised a marvelously ingenious engraving machine, and in 1840 machines for pressing glass tumblers. He also made important improvements in drilling machines, and in 1847 erected in New York the first cast iron building, we believe, ever constructed.

We now reach the period when the discoveries of Professor Joseph Henry, foremost of living American scientists, were made known. Previous to his investigations, the means of developing magnetism in soft iron were imperfectly understood. He was the first to prove by actual experiment that, in order to develop magnetic power at a distance, a galvanic battery of intensity must be employed to project the current through the long conductor, and that a magnet surrounded by many turns of one long wire must be used to receive this current. He was also the first to actually magnetize a piece of iron at a distance, and he invented the first machine moved by the agency of electromagnetism. In 1829 he exhibited to the Albany Institute electromagnets of power superior to any before known; in 1831 he transmitted signals by an electromagnet through a wire more than a mile in length, and caused a bell to ring. In 1833, while Professor of Natural Philosophy at Princeton College, he explained the electromagnetic telegraph, but he never reduced the principles described to actual practice. Professor Henry also as early as 1830 demonstrated that the discharge of a Leyden jar consists of a series of oscillations backward and forward, a fact afterward by him proved true of lightning. He also made the remarkable discovery that a voltaic current induces an extra current in the conductor in which it is itself conveyed, which, however, manifests itself only on making or breaking connection with the battery. The system of conductors adapted to the demonstration are flat spirals of copper ribbon, known as Henry's coils; and by these, induced currents of the ninth order have been demonstrated, and the possible number is theoretically unlimited.

The years 1830 to 1833 were prolific in electrical discovery. Following so close upon Henry's investigations as almost to be mingled with them came those of Dr. Charles G. Page. He invented ingenious electromagnetic locomotives, two of which pulled a car, weighing eleven tuns and carrying fourteen passengers, at the rate of nineteen miles an hour; he observed that the molecular changes in a bar of iron produced by magnetization are attended by audible sounds; he invented a pole changer whereby a magneto-electric machine may be made a substitute for a galvanic battery in electrolytic and galvanoplastic operations. He also devised the earliest form of induction coil, and made a large number of important discoveries in connection therewith, resulting in the invention of a spark-arresting circuit breaker.

It was in the autumn of 1832 that Samuel F. B. B. Morse, then an artist in painting by profession, embarked at Havre to return to this country. On that voyage, while in casual conversation with a passenger on the recent discovery of the relation of electricity and magnetism, he conceived the idea of the electromagnetic and chemical recording telegraph substantially as it now exists. Before the close of the year a part of the apparatus was constructed in New York; but the telegraph was not experimentally exhibited in operation until 1835. In 1837 he filed a caveat and sought, fruitlessly, Congressional pecuniary aid. From this time, the inventor's life was a continued struggle against scanty means and adverse circumstances, until the session of Congress of 1842-3, when he obtained an appropriation, and in 1844 the experimental line between New York and Washington was completed, and the practicability of the electromagnetic telegraph demonstrated. To Professor Morse is also due the origination of submarine telegraphy, and the first submerged lines were laid by him in New York harbor in 1842. He also made the first daguerreotype apparatus and took the first sun pictures produced in America.

In 1832 Edward Evans patented the method of unhairing hides by sweating, without the use of lime. During the same year, Dr. Samuel Guthrie, of Sackett's Harbor, N. Y., discovered chloroform, although he did not understand its true constitution, and called it chloric ether. At this period also was produced the first lock stitch sewing machine, by Walter Hunt. Hunt made and sold his machines, but was an erratic genius, too versatile to be successful, and through his sheer negligence lost the opportunity of acquiring the fame and fortune which Elias Howe and other patentees subsequently realized. In 1832 M. W. Baldwin, of Philadelphia, was engaged in perfecting many of his numerous inventions in locomotive mechanism. He devised the plan of attaching cylinders to the outside of the smoke box, metallic ground joints, and other valuable improvements. His most important invention was the flexible truck locomotive, patented in 1842. Seth Boyden, of Newark, N. J., had already discovered the japan or varnish by which patent leather is produced, and had laid the foundation of the manufacture of that material, which has been successfully carried on at the latter place ever since. He also pursued experiments with a view to converting the hardest laminated iron into soft malleable iron; and these succeeding, he began making malleable iron castings, between 1831 and 1835. He subsequently invented several important improvements in steam engines, notably the cut-off instead of the throttle valve, and the connection between cut-off and governor. The first practical automatic pin machine appeared in 1832, and was the invention of Dr. John I. Howe, of Connecticut. It formed the head of the pin by dies from a coil of fine wire. In 1833, Hussey, of Maryland, made the first practical harvester. It had open fingers, with a knife reciprocating in the space. He was followed in 1834 by Cyrus H. McCormick, who invented the reaper, in which a sickel-edged sectional knife was reciprocated by mechanism from the drive wheel, and fingers gathered the grain. This was an invention of great importance; and it met with worldwide usage and secured great rewards to the inventor, who still carries on the business of manufacture on an enormous scale in Chicago.

In 1834 Professor Denison Olmsted, of New Haven, Conn., by observations of the great meteor shower of the preceding year, reached the theory that meteors are portions of a nebulous body drawn into the earth's atmosphere and inflamed by the heat generated by the resistance of the atmosphere to their motion. During the next year, Dr. J. W. Draper began his magnificent investigations of the actinic rays of the spectrum, which included experiments on the absorption of the chemical rays by solid and liquid media, the decomposi-

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tion of carbonic acid by light, the interference of chemical rays, the crystalization of substances by rays of light, the supposed magnetizing properties of light (which he found not to exist), and the effects of light upon vegetation. Dr. Draper was the first to photograph Fraunhofer's lines, the first to take a portrait by daguerreotypy, the first to suggest the relation between the spectra of incandescent bodies and their physical or chemical composition, the first to devise charts of the spectral lines of bodies, the first to explain the mechanical cause of flow of sap in plants, and that the yellow ray and not the violet produces the reduction of carbonic acid therein, and the first to photograph the moon. No one American investigator has made more original researches, or extended them over a wider field, or contributed more largely to the general progress of Science, than Dr. Draper.

In 1836, another great invention appeared in the shape of revolving fire arms, which were patented by Colonel Samuel Colt, of Hartford, Conn. These were first used in the Florida war of 1837; but it was not until the outbreak of the Mexican war of 1847 that Colt erected the works in Hartford which have since assumed such immense proportions. Colt also invented a submarine battery of great power. In the next year (1837), A. A. Wells patented the process now in general use for forming the bodies of fur hats by depositing the material directly on a perforated cone revolving in connection with an exhausting fan. At about this time John Ericsson successfully applied the screw propeller to purposes of navigation in England, and immediately thereafter emigrated to this country, to which belongs his subsequent record, of which mention will be made further on. In 1839 the United States government despatched an exploring expedition to the antartic regions. No other explorations of that part of the globe have since been made, and the somewhat doubtful report of an antartic continent, brought back by the United States' vessels, has not been fully verified. During the same year Charles Goodyear made the important invention of vulcanizing india rubber. He had already discovered a method of treating the surface of native india rubber by nitric acid, which allowed a surface of rubber to be exposed on goods, hitherto impracticable owing to the adhesiveness of the material. In the course of experiments in 1839, he found that a piece of rubber, mixed with ingredients among which was sulphur, upon being accidentally brought in contact with a red hot stove, was not melted; but that in certain portions it was charred, and in other portions remained elastic, though deprived of all adhesiveness. More than sixty patents were afterwards taken out by him for improvements in treating india rubber and on articles manufactured from it. In 1839 also Erastus B. Bigelow invented his power loom for weaving ingrain carpet. This machine could easily weave from twenty-five to twenty-seven yards per day, whereas the previous hand loom production never exceeded eight yards. The invention was followed later by a power loom for Brussels and tapestry carpets, one of the most ingenious pieces of mechanism ever devised. Mr. Bigelow also invented a machine for weaving coach lace, and another for weaving counterpanes, both of which are in extensive use.

Here we may close the review of a period remarkable for the number of great inventions made during its continuance. The original types then produced have since formed the foundation of thousands of modifications and improvements, and the end of making such changes seems far from being attained. Progress therefore since 1840, though rapid, is due to development of previous ideas, more perhaps than to origination of new ones.

Our next issue will contain a continued history of the more remarkable inventions and discoveries from 1840 up to the present time.

RECLAIMING THE STEPPES.

It is a well known fact that there exists in the southeastern portion of the Russian empire an immense basin, depressed below the level of the ocean. In this basin lies the Caspian Sea, and into it also flow the great rivers Ural and Volga, which drain a large portion of central Russia. In the course of ages, the rivers have carried down soil and formed vast deposits which have encroached upon the sea, contracting its dimensions and elevating its bottom in parts, so that for large vessels it is no longer wholly navigable. As the sea diminished in size, so did the supply of watery vapor in the adjacent atmosphere become less; and moisture failing, the land near by has gradually changed into a desert, which is steadily growing. It is thousands of years, probably, since the arid wastes or steppes began to form; but their spread has continued until now an immense region is unfit for human habitation.

To reclaim this desert and restore it to its former state of fertility is the object of a gigantic engineering project, recently suggested by Mr. Spalding, an American engineer resident in Europe. The plan involves the connection of the Caspian with the Black Sea by means of a canal, which is described in detail on another page of this issue. It appears that the surface of the Caspian is forty-eight feet lower than that of the Black Sea. Mr. Spalding proposes to excavate from the Caspian a cutting, 480 feet wide, westward to such a distance that at its western end it would reach a depth of 32 feet. The surface of the earth at that point would be 16 feet below the level of the Black Sea. The remainder of the distance is to be traversed by a narrower channel, 160 feet wide and 9·6 feet deep at the Black Sea end, and 16 feet deep at its junction with the broader cutting. This gives a fall of 6·4 feet between the two extremities of the narrower channel, and the total length of both cuttings is about 166 miles. It is calculated that the water from the Black Sea would flow, along the slope above mentioned, at the rate of ome 7·2 miles per hour, and that, if the channels remaineds at their original dimensions, it would take four hundred years to bring the Caspian to a level with the Black Sea. As, however, the action of the rapid stream would infallibly soon deepen and increase the width of the passage, Mr. Spalding estimates that in forty years the levels of the two seas would be so nearly the same that the channel would be navigable. This new Mediterranean could be traversed by large ships from the borders of Persia to about the fiftieth parallel of north latitude, along the estuaries of the Ural and Volga, and to a much greater distance by ships of small burden.

The importance of the work, judging from the results expected, is not exceeded by that of the Suez Canal. The world is none too large for its population; and to reclaim the hundreds of square miles of arid Russian steppes would be to add territory and natural resources of inestimable value, not only to the Russian empire, but to all humanity.

FRENCH ARTISANS AT THE CENTENNIAL.

It is to be regretted that a meeting, recently held in Paris for the purpose of raising a fund to enable one hundred and twenty French artisans to visit the Centennial, should have been made the scene of wild communistic harangues by such firebrands as Louis Blanc and Victor Hugo. The circumstance tends to put the workmen, who may be sent here with the funds obtained through such arguments, in the light of representatives of a cause which is the embodiment of demagoguery, and with which American workmen, proud as they are of our republican institutions, have no sympathy. We had a sufficiency of agitation of the communistic character during the strike of 1872; and to the credit of our working men be it said that, even when partisan feeling ran highest, they turned away in contempt from the blatant incitors who prated of "blood and bayonets" and denounced the authority of law.

If the French artisans come here simply as workmen seeking to learn, they will find their fellow craftsmen ready to welcome and to instruct them. If, on the other hand, they visit us as apostles of the doctrines of Rochefort, Hugo, and Blanc, while no one will challenge their right to their opinions, any attempts on their part to inculcate them will encounter a rebuff so emphasized as to leave no doubt as to its signification.

THE OPENING OF THE CENTENNIAL.

The simple but impressive ceremonies which marked the opening of the Centennial passed off in a way that must have satisfied the most sanguine anticipations. In the hurry of preparation some things are forgotten, and others are apt not to fall in their proper places at the specified time; but on this occasion the great machine started off with wonderful precision. The day in Philadelphia dawned wet and cloudy. During the previous twenty-four hours there had been heavy rains, and many remembered with some dismay the depressing effect of the drenching showers which fell during the opening of the Vienna Exposition. Long before the appointed hour, however, the clouds broke away and the sun burst forth, and the predictions of the "probabilities" that fair weather was at hand, to the relief of all concerned, were verified. As early as nine o'clock the gates were opened; and thousands of people surged into the grounds, flocking to the front of Memorial Hall, where every inch of space commanding a view was in a few moments occupied. By the time the ceremonies began, over one hundred thousand persons had assembled, packing an area fully half a mile in length by 250 yards in width. While the people were thronging in at one portal, the orchestra of two hundred musicians and the nine hundred singers were admitted at other entrances. Later, the invited guests began to arrive; and as the dignitaries, both national and foreign, took their places, the expectant throng vented its enthusiasm in prolonged cheering. A tempestuous burst of applause greeted the Brazilian Emperor, who, with the Empress, occupied seats on the platform; and when the President, accompanied by his military escort and by his cabinet ministers, arrived, the shouts were deafening. Quiet was not restored until the ceremonies were fairly opened by the orchestra playing the famous Centennial March, written by Richard Wagner. Musical critics speak highly of the composition; but it was generally conceded that it was not adapted for outdoor performance, as it contained very many passages wholly inaudible except to the few hundred in the immediate vicinity of the performers. This being over, Bishop Simpson advanced to the front of the platform and delivered a lengthy prayer, the immense throng, though but few could hear the speaker, maintaining perfect stillness and decorum. A magnificent burst of music followed, in which a thousand voices, accompanied by organ and orchestra, sang Whittier's Centennial Hymn, in the last portion of which nearly the whole audience joined, producing a volume of sound of indescribable grandeur. Hon. John Welsh, President of the Board of Finance, then formally presented the buildings to the Centennial Commission. The cantata written for the occasion, by Sidney Lanier, was next sung. The senseless words of this production were happily compensated for by the superb musical setting given them by Mr. Dudley Buck.

These preliminaries concluded, the first important speech was made, by General Hawley, President of the Centennial Commission. After reviewing the inception of the project of an international exposition, and briefly referring to the labors of those charged with its preparation, he concluded as follows:

"It has been the fervent hope of the Commission that, during this festival year, the people from all States and sections, of all creeds and churches, all parties and classes, burying all resentments, would come up together to this birthplace of our liberties, to study the evidence of our resources; to measure the progress of a hundred years; and to examine to our profit the wonderful products of other lands; but especially to join hands in a perfect fraternity, and to promise the God of our fathers that the new country will surpass the old in the true glories of civilization. And furthermore, that, from the association here of welcome visitors from all nations, there may result not alone great benefits to invention, manufactures, agriculture, trade, and commerce, but also stronger international friendships and more lasting peace.

"Thus reporting to you, Mr. President, under the laws of the government and the usage of similar occasions, in the name of the United States Centennial Commission, I present to your view the International Exhibition of 1876."

On the closing of this speech, President Grant began the reading of his address. It very briefly referred to the objects of the Exposition, and to the vast progress of the nation during the past century. At the words "I declare the International Exposition now open," the signal was given, and the national flag was run up on the great tower of the main building. The bells and steam whistles all over the city burst into a chorus of noises, with which were mingled the thunder of the saluting batteries. The orchestra, organ, and singers pealed forth the Hallelujah Chorus, and the procession of invited guests, headed by the President and Emperor, was then formed, and the march through the Main Building began.

During the morning, the two great engines had been started at intervals, and every bearing had been freshly oiled, so that no possible obstacle could exist to prevent their formal beginning of work at the proper time. Mr. Corliss stood by his gigantic offspring, waiting the arrival of the President. As the head of the procession reached the engines, General Grant and Emperor Dom Pedro stepped forward; and instructed by Mr. Corliss, each grasped the bright lever of a throttle valve. There was a moment's delay for the dignitaries to gather, and then, at 1.20 o'clock, Mr. Corliss waved his hand, the signal for admitting the steam to the cylinders of the gigantic machines. It was a scene to be remembered; and perhaps for the first time in the history of mankind, two of the greatest rulers in the world obeyed the order of an inventor citizen.

The Emperor, with his characteristic energy, was the quickest to move his lever, but the President was but a second behind; and as the motion was completed, the steam hissed into the great cylinders, the mighty arms of metal slowly began their movement, pulleys answered to the strain of belts, and the mechanism of the vast building started into life and activity. The Empress of Brazil meanwhile visited the Women's Pavilion, and there pulled a golden cord which set in motion the engine that drives the looms Thus ended the ceremonial part of the opening, and the people scattered themselves over the grounds and through the buildings, while throngs visited the restaurants, and literally devoured every ounce of food which had been supplied; and by four o'clock, when President Grant and the Emperor returned to the grounds and sought to dine at the principal restaurant, they found several thousand hungry American sovereigns had been there before them, and they were obliged to go elsewhere for their dinner.

The interiors of some of the buildings, by dint of day and night work of a multitude of workmen during the past week, have been partially reduced to order; but here and there, and almost everywhere, a wilderness of packing boxes and rubbish is to be met with, and it will be some time yet before every department will be in perfect order.

It is impossible, at the present writing, to form any adequate idea as to the variety and novelty of the exhibits. The objects are there, but they are yet to be arranged and classified; and until this is done, a description of them, and a comparison with what we are used to seeing, must be deferred.

Government Provision for Mechanics at the Centennial.

We learn that a bill has been introduced in the House of Representatives, directing the President to appoint six skilled mechanics from each Congressional district, "whose duty it will be to attend the Centennial International Exposition at Philadelphia, carefully study the arts, industries, and products there exhibited, and make full report in writing of all that, in their judgment, is important and useful to the practical and scientific industries of this country." It is further provided that they shall be paid for their work "such sum as the Secretary of the Treasury shall deem a fair compensation." There are 292 Congressional districts, so that the corps of skilled mechanics will number over 1,750 persons. If they all attend the exhibition every day, a very comfortable addition will be made to its daily receipts at the expense of the government.

The constitutional authority to incur this expenditure will probably be found, says the *Evening Post*, just where the authority to establish a department of agriculture and an education bureau was found. Most persons will agree, however, that, if the enlightened people of this country do not take the trouble to learn for themselves what there is important and useful in the exhibition, they do not deserve to have a paternal government do it for them.

Publishing the English Patents.

The London Patent Office is about to adopt our Patent Office system of producing copies of drawings of patents by the photo-lithographic process, in place of the large lithographic sheets which now accompany the printed specifications of all English patents. Considerable opposition to this change was made by the London patent agents; but we believe it only arose from abhorrence of change, which is the national characteristic of the Englishman. But the British public will soon find our mode of producing copies far better than their old plan of lithography.

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THE CENTENNIAL INTERNATIONAL EXHIBITION.

We resume our description of the buildings erected for the Centennial Exposition, the most important of which were illustrated in our last issue. The above engraving represents the pavilion erected by the State of New York, a building in the villa style, with a verandah all around it. It is the headquarters of the New York commissioners, and will, no doubt, like the other State buildings, be a meeting place for exhibitors and visitors, from the Empire State.

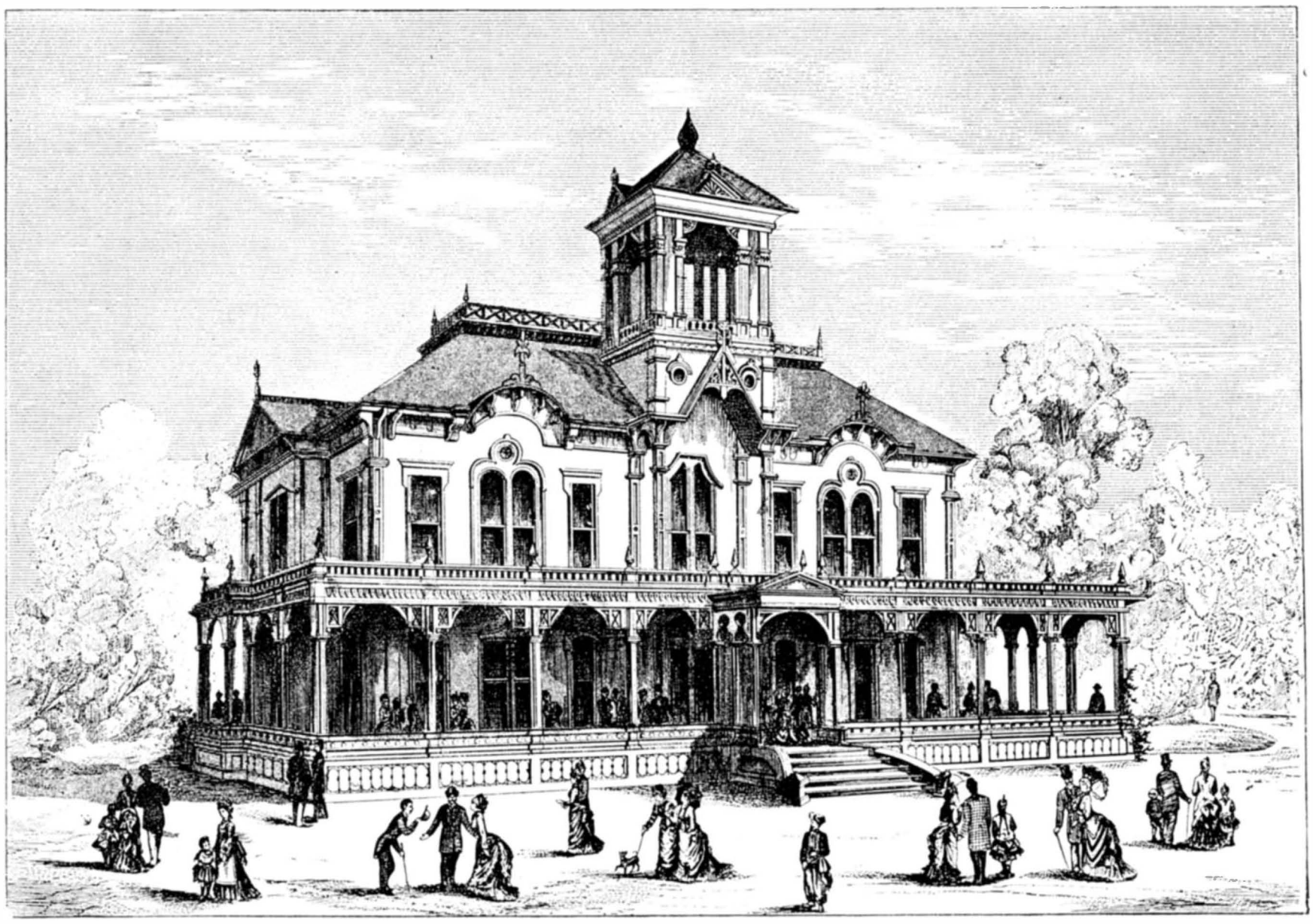
A very attractive feature of the Exposition will be the various restaurants, which will represent the culinary art of many nations. The largest of these is specially dedicated to American cookery. It is situated near the Agricultural Hall, and encloses three sides of a quadrangle, giving the visitors an opportunity of dining in the fresh air or on the shady piazzas with which the building is surrounded. A large hall and several private dining rooms are also at the disposal of guests. Messrs. Delmonico are, we believe, to have a building, and the owners of *Les Trois Frères Provençeaux*, of the Palais Royal, Paris, which for sixty years has held the highest rank in Europe for the excellence of its *cuisine* and wines, are to exhibit to the visitors the gastronomic science of the city of good cooks. Mr. Edward Mercer, of Atlanta, Ga., has erected the building shown in our second illustration; it is 185 by 96 feet, and contains four large dining rooms. A band of "genuine plantation minstrels" is to divert the diners during the repast, and the bills of fare are to be thoroughly representative of the manners of the Southern States. There is also the Vienna bakery, already alluded to in these columns; and there is a Turkish *café*, where the tiny cup of Arabian coffee, with a long pipe of the Persian pattern or the Turkish *nargilyeh*, through the perfumed water of which the smoke is drawn, may be enjoyed for the first time, probably, by most of the visitors.

Our next engraving represents the United States Government Building. It contains collections of objects sent by the various government departments, those from the army and navy being especially interesting. The structure is in the form of a cross, 360 by 300 feet, and the 81,600 square feet of floor space are appropriated as follows: To the war department, 11,200; navy department, 10,400; interior department, 20,600; treasury department, 3,000; post office department, 3,800; Smithsonian Institute, including fish commission, 26,600; agricultural department, 6,000.

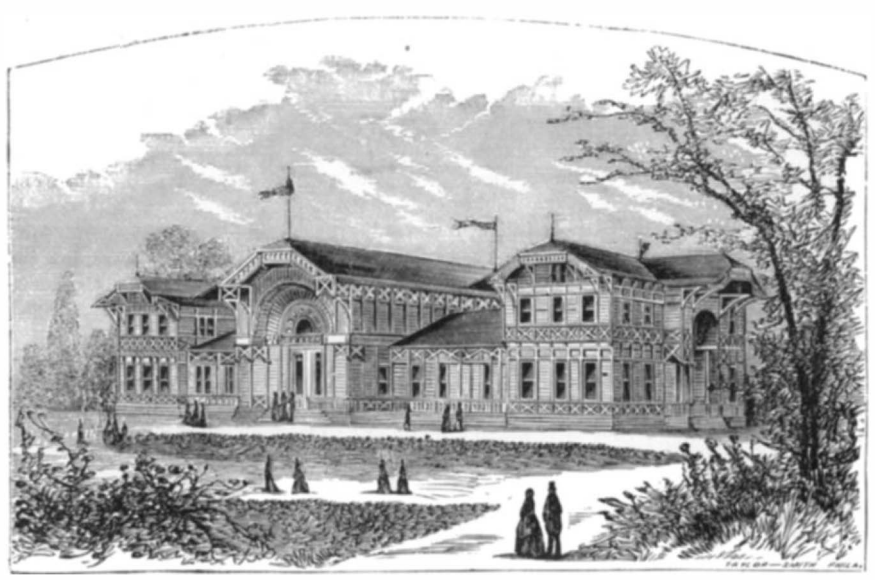
The main stem of the building and its transept are traversed centrally by walks, which cross in the center under the rotunda or lantern, crossing the intersection. The principal area of the cross consists of three aisles, which have side lights beneath the eaves, the central aisle rising above the side aisle and having ventilators at the comb. The transept has a single aisle. Each of the departments has drawn upon its own stores for articles to exhibit, the objects having in many cases great historical interest, appertaining to the aboriginal inhabitants of the country, the settlement, the revolutionary struggle, the later wars, the peaceful arts, progress, surveys, inventions, scientific expeditions and researches, and natural resources, the latter including metals and other minerals, animal and vegetable productions, and manufactured articles. The display of artillery and projectiles, maps, charts, etc., as well as of documents and papers, is likely to attract much attention; and machinery in motion will be employed to illustrate the manufacture of small arms, cartridges, army clothing, etc.

Photographic science will be shown not only in the building described and illustrated in our last issue, but in one erected by a company especially organized for the purpose of taking photographs in the buildings, and for selling them in the Exposition, to which privilege it has the exclusive right. The building is admirably constructed and arranged; and the company numbers among its members photographers from all parts of the country and Canada. Mr. Edward L. Wilson, editor of the Philadelphia *Photographer*, is the treasurer, and Mr. John A. Fraser, of Toronto, is the art superintendent of the company.

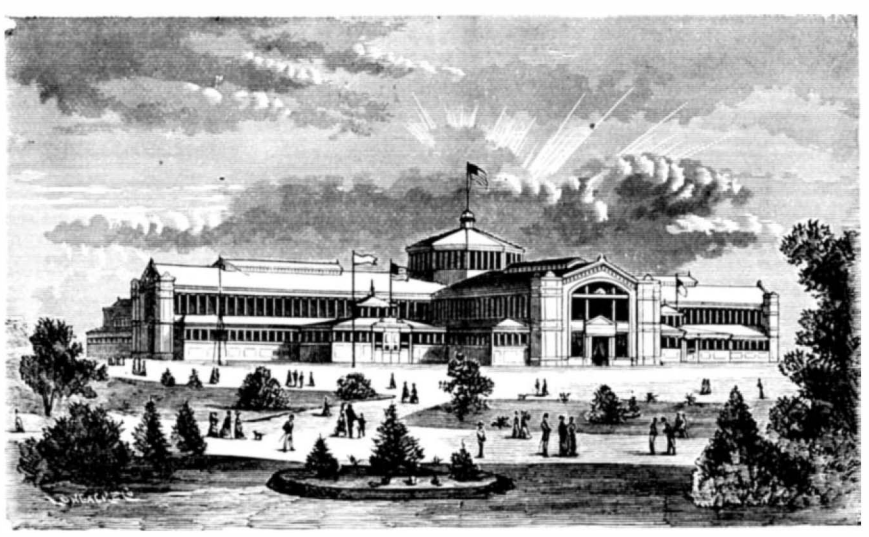
The next and last building in our present series is one erected by private enterprise; it is called the World's Ticket and Inquiry Office, and is built by Messrs. Cook, Son, & Jenkins, the renowned agents for pleasure tours in all countries. It is a well built, elegant pavilion, with offices for the sale of tickets, hotel coupons, etc., and the affording of information and facilities for traveling to and from all parts of the world; but in addition to the utilitarian purposes of this firm, they provide one of the most attractive features of the Exposition in the display of their celebrated Palestine camp, illustrating their method of caring for travelers in that interesting country; besides which they illustrate a number of other most interesting facts connected with travel



THE NEW YORK STATE BUILDING.



"THE SOUTH" RESTAURANT



THE UNITED STATES GOVERNMENT BUILDING

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and life in distant countries. Among these attractions is the boy Selim, so famous in Mr. Stanley's tour of search after the late Dr. Livingstone.

There are many attractive features in the grounds which surround the buildings. North of Machinery Hall is a pretty little lake covering about five acres of ground, with sloping banks covered with grass and shrubbery. The spacious grounds in front of Horticultural Hall are dotted with parterres of flowers and traversed by a sunken garden leading up to the portals of the Hall. The grassy expanse of flowers and turf is bordered by a fringe of fine trees; and the cool valleys of Lansdowne and Belmont, on either hand, furnish denser masses of shade to relieve the brightness of the scene. The esplanade, adjoining the main entrance to the grounds, has also been prettily ornamented with flowering shrubs; and in the center is Bartholdi's large bronze fountain, representing Light and Water, "the twin goddesses of cities." West of the Machinery Hall stands the great fountain of the Catholic Total Abstinence Society, which, next to the Centennial fountain, is much the most costly work of the kind in America. The center figure represents Moses smiting the rock, and the four subordinate ones are statues of Father Mathew, Charles Carroll, Archbishop Carroll, and Commodore Barry.

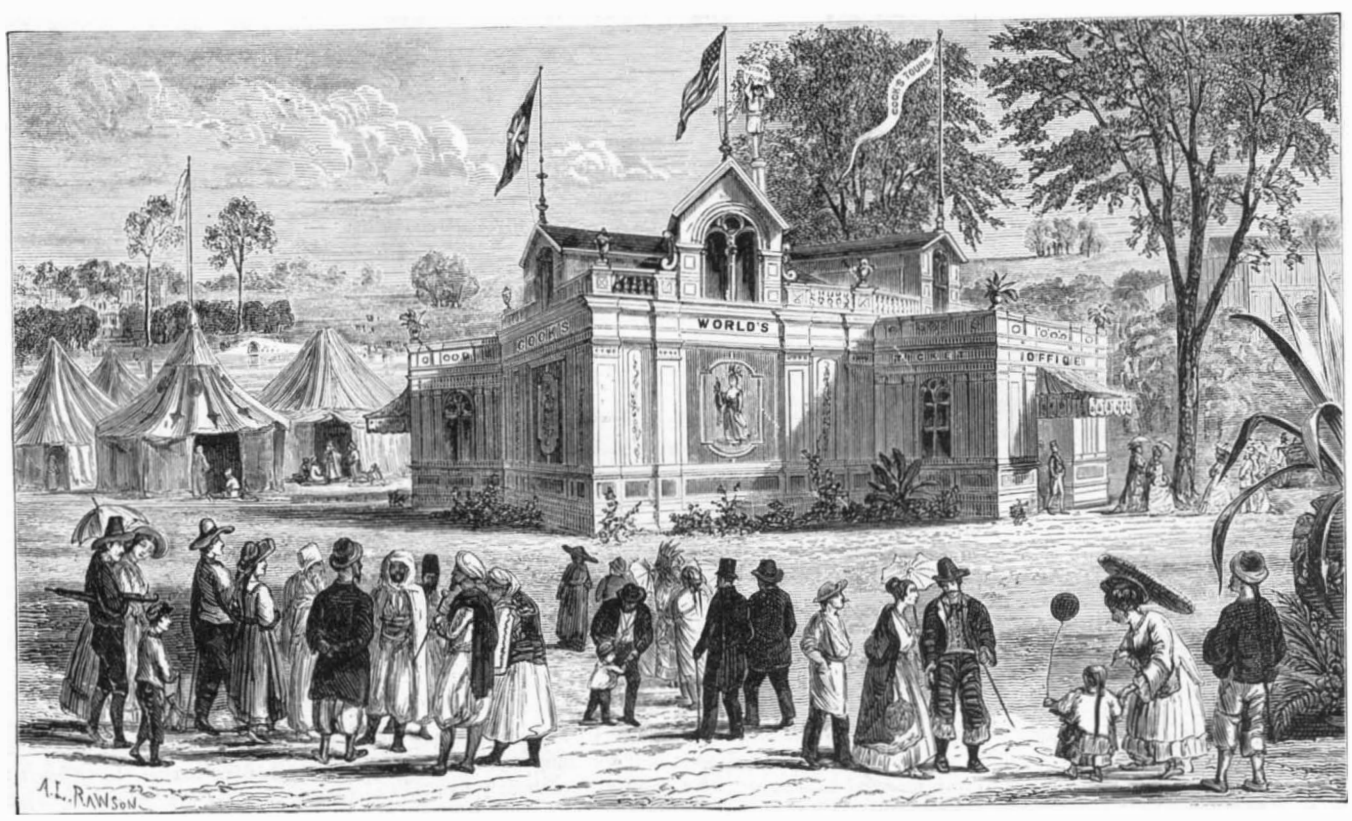
THE CENTENNIAL PHOTOGRAPHIC COMPANY'S HALL.

Dr. W. W. Hall.

We learn with painful regret of the sudden death of Dr. William W. Hall, the well known editor of *Hall's Journal of Health*. Dr. Hall was born in Paris, Ky., in 1810. After completing his education he entered the ministry, and while performing missionary labors found a knowledge of medicine so indispensable that he began systematically to study the healing art. Subsequently he devoted himself to that profession, practising successfully first in Cincinnati and New Orleans, and latterly in this city.

Dr. Hall possessed an extraordinary faculty for popularizing medical knowledge. He was the first to start a popular journal devoted to the inculcation of the laws of health and correct living, in which the articles were written in so clear and plain a style as to be comprehensible by any one. The fact that the *Journal of Health*, which was issued first in 1853, soon attracted a circulation of 25,000 copies, shows the favor with which the public regarded his labors. Dr. Hall prided himself on writing his whole paper unaided; and as he was master of a concise, epigrammatic way of expressing ideas, it was rarely that a copy of the journal could be perused without some useful suggestion being fixed in the mind. Besides his editorial labors, Dr. Hall found time to prepare a number of valuable works on sanitary topics, which have added to his general reputation

It is a remarkable fact that one so well posted in sanitary laws should have died through the violation of precepts which he persistently urged upon others. It seems that for some years past Dr. Hall has greatly overtasked himself in his literary labors, rising at 5 in the morning, and working almost continuously until 10 at night. The physical results of mental overwork are fully known, and perhaps few understood them better than Dr. Hall himself. Yet he fell dead in the street, and subsequent examination has revealed the cause of his death to be degeneration of the heart, one of the commonest results and, according to recent investigations, an almost necessary consequence of an overtaxed brain.



THE WORLD'S TICKET AND INQUIRY OFFICE.

NEW YORK ACADEMY OF SCIENCES.

The chemical section of this society met at 64 Madison avenue, Monday evening, May 8, 1875. After the conclusion of some ordinary routine business, Professor Falke created quite a sensation by exhibiting a quantity of

MERCURY FOUND IN CANNED MEAT

He stated that, on opening a can of cooked corned beef, put up by a company in Chicago, he noticed some bright metallic globules, which proved to be metallic mercury. Beside these, a considerable quantity of combined mercury was present in the form of albuminate of mercury. How the poison came in the meat is a mystery; but a member suggested that, inasmuch as thermometers are employed to regulate the temperature when canning, the mercury may have come from a broken thermometer. It may be interesting to note that a case of poisoning has been reported in Boston from eating canned cooked corned beef. Another member of the Academy informs us that he too suffered severely after eating 2 ozs. of this beef, but is uncertain whether mercury was the real cause of the affliction.

SEPARATION OF BISMUTH, CADMIUM, AND COPPER IN QUALITATIVE ANALYSIS

formed the title of a paper by M. W. Iles, Ph. B. The substance of this discovery has already been published in the SCIENTIFIC AMERICAN SUPPLEMENT. The three metals are precipitated by ferricyanide of potassium; the copper and cadmium are redissolved in excess of cyanide of potassium. K Cy, and tested for in separate portions of the filtrate, the former by hydrochloric acid, H Cl, the latter by ammonia sulphide.

JAPANESE PAPER

Professor Henry S. Munroe, E. M., exhibited a number of specimens of Japanese paper, and described minutely the materials employed, method of manufacture, and uses of this curious material. The Japanese paper, said Professor Munroe, is all made from the inner bark of the mulberry, and is never bleached, although made as clean as possible: hence its faint yellow green or pinkish color. Paper is made in small villages where all the inhabitants are papermakers, just as other small villages consist entirely of blacksmiths, and so of other trades. The sons of papermakers follow the profession of their fathers unless adopted into a family pursuing some other vocation.

The paper mulberry, of which the paper is made, is propagated by cuttings from the roots, which are planted on the borders of rice fields, and mature in five years. In November the reeds are cut and sold to the papermakers; and the roots are left to send up new shoots. The shoots are cut in pieces two feet long, piled up and allowed to ferment, which loosens the bark so that it can be stripped off, after which they are dried in the open air, or scraped at once. The scraping removes the brown epidermis, which can be used for inferior wrapping paper. About 33 lbs. of the bark is boiled at one time for two hours in a strong lye made from wood ashes. It is then put in bags and left in a running stream until the alkali is washed out completely. It is next beaten, 2 or 3 lbs. at a time, on a wooden block with heavy sticks, for 15 or 20 minutes. This pulp is now mixed with a little rice paste, or a paste from a species of mallow. A thin pulp is obtained by stirring ¼ pound of this mass into 40 or 50 gallons of water. The web or mat on which the paper pulp is collected is made of slender strips of bamboo, only the thirty-sixth part of an inch in diameter; several hundred of these are bound together with silk threads; the rods all run lengthwise of the sheet and hence the mats can be rolled or folded up in one direction. A branch of the nobility monopolizes the manufacture of these mats. For coarse paper, reed mats are employed. The process of manufacture is essential the same as in making handmade paper elsewhere. A woman sits in front of the tank and stirs it vigorously, then dips a mat and frame into the vat, takes up some of the pulp and shakes it so as to arrange the fibers parallel. A single dip makes a very thin tissue paper; most paper is made by dipping twice, and draining each time. After the second dipping, the mat is stood up edgewise by the side of the tank to drain, and the frame put on a second mat which also receives its first dipping. While the second sheet is draining for the first time, the mat with the first sheet is laid face down on a pile of finished sheets with a rice straw between them. While the second sheet is draining a second time, the mat is taken off from the first sheet, so that only two mats are necessary. When 500 or 600 sheets, which form a day's work, are completed, they are pressed for some time with heavy weights, then taken up one at a time, by means of the rice straw, and placed by old men on smooth boards to dry in the sun. When dry, the sheets are stripped from the board by a sharp knife with the blade at right angles to the handle like a sickel. The finished paper weighs about one half as much as the bark employed.

Professor Munroe exhibited various kinds of fancy paper from Japan, and another member exhibited a Chinese book, said to be a translation of Professor Tyndall's work on sound, illustrated.

At the close of the regular meeting, Professor A. R. Leeds was elected chairman of the chemical section; and a committee was appointed to consider the subject of having a course of public lectures on Science, next season.

MINERALS.

Professor A. E Foote, of Philadelphia, exhibited through Mr. Hallock some fine specimens of rare minerals, including petzite, molybdenite, embolite, amazon stone, and titanium.

The meeting was adjourned to June 12, 1876.

A New Test.

To detect nitrobenzol in oil of bitter almonds; Take a solution of chloride of tin, and add excess of caustic soda until the precipitate dissolves, then add a few drops of the substance to be tested, and heat. If nitrobenzol is present, it will be reduced to aniline. Next, add a few drops of carbolic acid and some hypochlorite of soda (Javelle water), when the peculiar purple color is produced.

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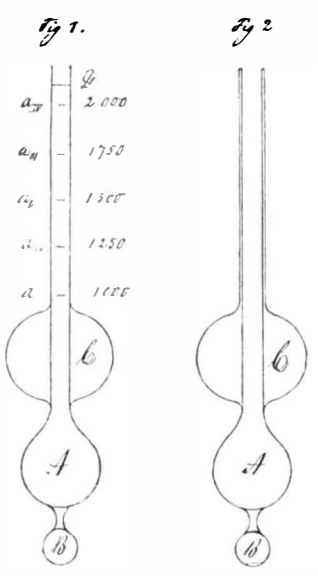
Correspondence.

A Picno-Hydrometer.

To the Editor of the Scientific American:

I send a description of a new scientific instrument of my invention; it may perhaps interest the scientific public. It is for determining the specific gravity of fluids as well as of solids. Its construction is based on the combined principles of the picnometer or specific gravity glass and the hydrometer. It is especially adapted to the determination of the gravity of fluids when only small quantities can be obtained, when they are of such a nature that they can only be kept in glass vessels, such as strong acids and the like.

A is a spherical glass vessel to which a long neck is attached, corresponding to the stem of the common hydrometer. B is a smaller closed bulb that contains shot, mercury, or other heavy object. This may be dispensed with if the bulb, A, is made of heavy glass. Around the stem or neck of the vessel, A, just above that vessel, there is blown another bulb, C, which serves as a float. The upper end of the stem is open. The instrument, instead of floating in the fluid the specific gravity of which is to be determined, is filled with a fluid to a mark, D, on the neck, and put in water. The degrees are marked on the glass by etching with hydrofluoric acid, or a paper scale may be used, as shown in Fig. 2. The paper can be inserted in the space between the two tubes, and the upper edges sealed together.



If we fill the instrument with water and let it float in water, the proportions of the instrument being such that it sinks to a, it will serve for determining the specific gravity of fluids heavier than water. If it sinks to a_{10}, then a_{10} will be 1·000 of the scale, and will serve for fluids lighter than water. In the first case, a being 1·000, if we fill the instrument with any heavier fluid and put it into water, it will sink in farther than a, say to a_1, being 1·250. As the volume of the fluids to be weighed is always the same, it will be readily understood that a similar addition to the specific gravity (as from 1·000 to 1·250 and from 1·250 to 1·500) will require equal additions to the volume of water displaced. In other words, the distances of the marks 1·000 to 1·250 and 1·250 to 1·500 will be equal, provided the stem is cylindrical. This is the only instrument having a specific gravity scale of which the degrees are equidistant. Further, if the instrument be so made that the volume of the inner vessel be known, such as 10 cubic centimeters, it can be used to weigh off any quantity of a fluid or solid substance (which must be in pieces small enough to enter) from 10 to 20 grains, or as far as the scale goes. The instrument may thus serve as a balance for preparing solutions of standard strengths. It may be also used for determining the specific gravity of solids. The method is nearly the same as with the usual specific gravity glass or picnometer and the chemist's balance. Thus: Given a substance not soluble in water, the specific gravity of which is x. If we put enough of it into the instrument to make it sink in water to 1·250, and fill up with water to the mark, and immerse again in water, it will sink now to, say, 1·750. Then calling the absolute weight of the water which the instrument will hold w, the absolute weight of the substance will be $w \times 1{\cdot}250$. The weight of the contents of the instrument, after filling up with water, will be $w \times 1{\cdot}750$, and the weight of the water added will be w (1·750 — 1·250), and the weight of the water displaced by the substance $w - w$ (1·750 — 1·250) = w (1 — 1·750 + 1·250 = $w \times 0{\cdot}5$. By dividing the absolute weight of the substance by the weight of the water it displaces, $\frac{w \times 1{\cdot}250}{w \times 0{\cdot}5}$, we show its specific gravity, 2·500.

The results of the determinations with this instrument are not influenced by variations from the mean temperature, as the gravity of the fluid is always compared with water of the same temperature.

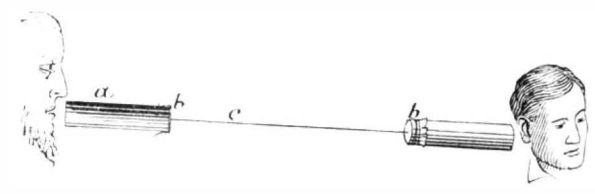
Your readers will doubtless find many uses to which this little instrument can be put. HERMANN WIEGAND.

St. Louis, Mo.

A Thread Telegraph.

To the Editor of the Scientific American:

A cheap telegraph, useful for certain purposes, can be made in this way: Take two tin cylinders about the size of a small dice box, say 3 inches long by 1¼ inches diameter;



THE TWO CENT TELEGRAPH.

cover one end of each with parchment or bladder, forming a drumhead. Pierce the center with a pin and insert a strong thread, and make a knot to prevent its being withdrawn. With the other end of the thread (which may be of any length, say 100 yards or more) do likewise with the other cylinder, and the telegraph is complete. By keeping the thread tightly drawn, in order that the vibration may be perfect, a person speaking or even whispering in one cylinder can be distinctly heard by another holding the other cylinder to the ear.

Would not such home-made pocket telegraphs be very useful in factories, on farms, in the army, and in many other situations too innumerable to mention? An enterprising person might realize a handsome sum by making them as scientific toys for the Centennial Exhibition. The tubes could be made of cane pole, and I would suggest that they be made to fit one within the other, so as to be easily carried. Stronger ones can be made with small cord, but would be more bulky. GEO. QUINCY THORNDIKE.

Mentone, Alpes Maritimes, France.

[For the Scientific American.]

SETTING ENGINE GUIDE BARS.

Several of our correspondents are troubled with the difficulty of setting the guide bars upon the bed of a horizontal engine so as to ensure that the piston head has an equal amount of clearance, from the cylinder head, at each end of the stroke, and at the same time so that the guide blocks will travel to an equal amount over the recesses at each end of the guide bars. Below we give a practical method of obtaining this result.

Our first operation is to ascertain the length of the bore of the cylinder, measured from inside face to inside face of the cylinder covers, which we may do by subtracting from the whole length of the bore the depth to which the covers enter it at each end; then from the remainder we subtract the thickness of the piston head, exclusive of the bolt heads, if they project; and the last remainder will be the length of the bore of the cylinder (allowed for the stroke of the piston) *plus* the clearance between the cylinder covers and the piston head when it is at each end of the stroke. From the remainder so obtained, we subtract the length of the engine stroke, that is to say, twice the length of the crank from the center of the shaft to the center of the crank pin; and this last remainder will be the amount of length of the bore of the cylinder allowed for clearance, which, divided by 2, will give the amount of clearance at each end of the stroke. If, then, we add the amount of this clearance to the depth to which one cylinder cover fits into the cylinder, the sum will be the distance from the face of the piston head to the end face of the cylinder. Then we may carefully clean and oil the cylinder bore, piston rod, and piston, and then put the latter in its place in the cylinder, taking care that the distance from the face of the piston head to the end face of the cylinder end is that ascertained as above; and then the piston will be at one end of its stroke, and will allow amounts of clearance, equal at each end of the cylinder.

Our next operation is to find the exact position of the crosshead when it is at that end of the stroke which corresponds with the position of the piston; and we proceed as follows: There should be upon all guide bars a recess at each end of the working face, so that the guide blocks will, at each end of the stroke, travel over these recesses, and thus prevent the formation of shoulders on the guide bars. The distance, then, on each bar, between these recesses will be less than the length of the stroke; and we therefore subtract the distance from recess to recess, on a bar, from the length of the engine stroke, and the remainder will be the amount allowed for the guide bars to travel over the recesses, which, divided by 2, will give the allowance for overtravel at each end; and we mark such allowance upon the guide bar at the end corresponding to the end of the stroke at which the piston stands. We now place the crosshead upon the piston rod, and then put the guide blocks upon the crosshead, and adjust the guide bars upon the engine bed, so that the end of the guide block stands even with the mark above referred to, and the operation is complete.

New York city. JOSHUA ROSE.

A Great Explosion.

A tremendous explosion of the nitroglycerin compound known as rend-rock powder recently occurred on Bergen Hill, New Jersey, directly opposite New York city. The material was to be employed for blasting in the new tunnel of the Delaware, Lackawanna, and Western Railroad Company, and was stored in a brick magazine some ten by twelve feet in area and nine feet in hight. Estimates place the amount of powder that blew up at about four hundred pounds. The concussion was terrific, and the effects were felt over a radius of some ten miles. Thousands of sashes and doors in the vicinity were forced in, and even across the river in New York the glass in edifices along the water front was shattered. Houses at a distance of nearly five miles were perceptibly shaken. Fortunately the building in which the powder was stored was located in a large empty lot and on the brow of the hill; and the force of the explosion spending itself eastwardly, most of the fragments were hurled harmlessly into the marsh below. The great damage which must have ensued had the locality been thickly built up was thus avoided; and the injuries were confined to the wholesale destruction of doors, windows, and ceilings in the neighborhood.

The cause of the disaster is unknown. The accident points to the necessity, however, of the enforcement of stringent laws, preventing the storing of any of the new and powerful explosives, in large quantities, in the vicinity of any populated district, and also regulating its transportation

Influence of Light on the Color of Flowers.

Dr. Askenasy, in the *Botanische Zeitung*, records the results of some experiments instituted by him to ascertain the influence of light on the colors of different flowers. In the main, his results agree with those obtained by Sachs; but if the different plants he employed to test the degree of influence exercised by light can be regarded as of equal value, then the degree of influence is very diverse in different plants. Scarlet and white, scarlet and yellow, and wholly yellow flowered sorts of *tulipa Gesneriana*, grown in absolute darkness, exhibited no appreciable difference in the shape or color, or intensity of color, of the flowers from those of the same varieties grown in the full light. Blue and yellow flowered varieties of *crocus vernus* developed their proper colors, but the flowers were very much drawn up, as gardeners express it. The effects of light on a dark violet blue variety of *hyacinthus orientalis* were of a double nature, with the same temperature. Those grown in the light were at least a fortnight in advance of those grown in the dark, and much more highly colored, though those grown in the dark were not absolutely colorless. To prove this, Dr. Askenasy cut off the upper portion of the spikes of several of the plants growing in the dark, and placed these portions in water, fully exposed to light, on the south side of a greenhouse. In three days the expanding flowers were of as deep a hue as the normal ones, proving also that the change of color so effected was entirely independent of previous formation of chlorophyl. The flowers of *pulmonaria officinalis* formed less color according to the stage of their development when darkened, and those in a very young state were quite white. The flowers of several other plants were affected in the same manner; hence it appears that those cases in which the colors are not influenced by light must be regarded as exceptional.—*Academy*.

Union of the Caspian and Black Seas.

The present century has witnessed several remarkable achievements in marine engineering, such a sthe drainage of extensive arms of the sea in Holland, the construction of the Suez Canal, and the deepening of the estuary of the Mississippi; and these not being enough, still more gigantic schemes have been projected. It has been proposed to admit the Mediterranean into two extensive tracts of the Sahara, which would give water communication to a large portion of Algeria, and make a seaport of Timbuctoo. Neither plan is likely to be put speedily into execution; but in the meantime, Mr. H. T. Spalding, of Blomfield, N. J., comes to the front with a proposal to turn the waters, of the Black Sea into the Caspian, thus enlarging the latter to its pristine size, and turning the barren and almost impassable deserts, left by the subsidence of its waters, into a highway of commerce for Central Asia. This ancient sea basin is considerably depressed below the general ocean level, and has been silted up in the course of ages by the Ural, Volga, and other lesser streams which flow into it. The consequence of this contraction and shallowing of the Caspian has been, not only that the land left dry is incurably barren, but that the surrounding country has become unfruitful from want of rain, consequent on the diminished evaporation. Mr. Spalding proposes, as we have said, to restore to the Caspian its ancient body of waters, its ancient depth and area, which was nearly double its present extent, by connecting it with the Black Sea by a channel 150 miles in length, about 170 yards wide at its eastern extremity, but two thirds narrower on the western half. The projector calculates that, at the end of forty years from the beginning of the work, the level of the two seas would be so nearly uniform that the navigation of the new channel could begin. Mr. Spalding further proposes to join the Don to the Volga, and thus lay the Sea of Azof also under contribution. The mere excavation of the proposed canal does not seem very difficult; and as the Russian government appears to have directed its attention to the scheme, doubtless the opinion of competent scientific men as to its feasibility will be obtained. If it should prove successful it would be a magnificent work, and followed by political and economic results more than commensurate with the skill and outlay that would be required for its completion.—*Iron*.

New Discovery in Agriculture.

The curious discovery is announced by Professor P. B. Wilson, of Washington University, Baltimore, that minutely pulverized silica is taken up in a free state by plants from the soil, and that such silica is assimilated without chemical or other change. The experiment, of which we give a more full account in our SUPPLEMENT of this week, consisted in fertilizing a field of wheat with the infusorial earth found near Richmond, Va. This earth, it is well known, consists of the shells of microscopic marine insects, known as diatoms, which under strong magnifying powers reveal many beautiful forms that have been resolved, classified, and named. After the wheat was grown Professor Wilson treated the straw with nitric acid, subjected the remains to microscopic test, and found therein the same kinds of shells or diatoms that are present in the Richmond earth, except that the larger sized shells were absent: showing that only silica particles below a certain degree of fineness can ascend the sap pores of the plant. This discovery opens up a new line of research in agricultural investigation from which important results and much additional knowledge may accrue.

THE AMERICAN CENTENNIAL JURIES.—The list of jurors at the Centennial was announced just as this issue was going to press, and the names will appear in our next.

ENGINEERING projects are under advisement for the regularization of the river Neva at St. Petersburgh, Russia.

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NITROGLYCERIN.

C TURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY G. M. MOWBRAY, ESQ., OF NORTH ADAMS, MASS.

Thirty years ago the German chemist Schönbein discovered that iron behaved in a peculiar manner when immersed in a mixture of concentrated nitric and sulphuric acids. Instead of dissolving, it remained perfectly passive and unchanged. This led him to test his solution by putting some cotton in it. To his great surprise, the cotton did not dissolve either. He took it out again, squeezed it out, washed out all the acid, and put it in the drying apparatus in order to have it ready for analysis the next day. When he came back, his cotton was not there, and none of his students of whom he inquired had seen anything of it. He was convinced that somebody had been very careless, and repeated the experiment. This time, however, the Professor himself witnessed the disappearance of his cotton when the heat became sufficiently strong; and this showed him that a change had taken place in its structure. The new compound received the name of gun cotton, and the inventor took out a patent for it in 1846. Sir John Herschel spoke in the strongest terms of its great explosive power. At a meeting of the British Association, he said: "It might in the next generation arm mankind with the very wildest powers, by which they could tear up rocks, and almost call down lightning." Everybody began to make it, exhibit it at the dinner table, and discuss the question whether it was a true chemical compound or only a mechanical mixture formed by the retention of some of the acid in the pores of the cotton. The dispute was settled by Sobrero, a pupil of Pélouze and now Professor of Chemistry in the University of Turin. Walter Crum having shown that gun cotton, or pyroxylin, is a compound in which some of the hydrogen of the cotton is replaced by hyponitric acid, Sobrero made similar compounds with gum, sugar, dextrin, manna, and finally with glycerin, where it was evident that there could be no simple absorption. This was in 1848. Nothing further was heard of his invention of nitroglycerin until the Crimean war, when it was rumored tha Admiral Napier was prevented from taking Cronstadt because he was afraid of torpedoes charged with the new terrible explosive by Professor Jacobs.

In 1864 the Swedish engineer Alfred Nobel obtained a patent for the application of nitroglycerin to blasting purposes. He found considerable difficulty in making it explode with certainty, and was obliged either to put gunpowder in the center of the nitroglycerin cartridge or nitroglycerin in the center of the gunpowder cartridge.

The lecturer next exhibited the properties of nitroglycerin. A slip of paper saturated with it was lighted, and burned with a light bluish flame; while another slip saturated with nitrobenzol, a similar compound, burned with a denser flame and gave off much dark smoke, showing the greater proportion of carbon in its composition. This nitrobenzol, from which artificial bitter almond flavoring is also made, is sometimes mixed with nitroglycerin in order to neutralize its explosive qualities and render it safe for transportation. It can then be exploded only by means of some powerful fulminate or by supplying it with oxygen through the addition of chlorate of potash.

A little nitroglycerin spread upon an anvil exploded with a loud report when struck with a hammer; nitroglycerin mixed with one third of nitrobenzol did not explode until chlorate of potash was added, and not then at the first trial.

The glycerin from which nitroglycerin made is so common a compound that it requires no description. It was first obtained as a residue in the manufacture of diachylon or lead plaster, obtained by boiling olive oil and litharge. It is perfectly soluble in water, and greedily absorbs moisture from the atmosphere; a tumbler nearly filled with glycerin will draw about $\frac{3}{8}$ of an inch of water from the air in a night. Nitroglycerin, on the contrary, is insoluble in water. When tasted or even touched with the hands, it produces a persistent throbbing headache; but the system soon becomes accustomed to it, and it then ceases to have any effect. Nitroglycerin is obtained by adding gradually $\frac{1}{2}$ lb. of glycerin to a mixture of 1 lb. of nitric acid and 2 lbs. of sulphuric acid. Various conditions enter into its manufacture, which cause the product to be more or less easily exploded. The result is glycerin in which one, two, or three equivalents of hydrogen are replaced by hyponitric acid.

The attention of the lecturer was first attracted to nitroglycerin in 1865, by several terrible explosions which it had caused. One occurred in New York city in Greenwich street, opposite the Wyoming Hotel. One of the guests of the hotel, on polishing his boots, had noticed a reddish vapor issuing from the box on which he rested his foot. The hotel clerk took the box outside and threw it into the gutter. An explosion instantly followed, by which every pane of glass within a hundred yards was shattered, pedestrians were thrown down, and the pavement broken up. It turned out that the box contained nitroglycerin, left by a guest as security for his board.

The next explosion was that of the steamer European, at Aspinwall, on the Isthmus of Panama. Forty-seven persons were killed, the vessel, the pier, and the warehouses near by were destroyed, and the damage was over a million dollars. Directly after this an explosion occurred in the express office of Wells, Fargo,& Co., corner of California and Montgomery streets, San Francisco. Eight persons lost their lives, and property to the amount of a quarter of a million dollars was destroyed.

Now here was a substance manufactured at Hamburgh, Germany; carted to the wharf; loaded on board of the steamer by stevedores; reshipped at London to Panama; a part of it forwarded across the Isthmus by railway; thence lightered to and loaded upon the steamer; bearing a twelve day's voyage to San Francisco, where it was taken to the express office; handled with the usual recklessness of expressmen, and yet it did not explode. These considerations led the lecturer to investigate the subject, after having maturely reflected on the question whether a man "who had a home ought to embark in so dangerous an enterprise," and having at one time concluded "that he had better keep a peanut stand" than have anything to do with nitroglycerin without thoroughly understanding its properties.

The following July (1867) the lecturer was sent for by the engineers of the Hoosac tunnel, who were desirous of finding some one who would take charge of the manufacture and use of nitroglycerin, and be responsible for it. He accepted the position on the condition of having absolute authority to employ and discharge all connected with the use of the explosive, and of managing the operation without interference from anybody.

A preliminary experiment with a charge of six ounces of nitroglycerin proved so powerful that those who heard the report thought his whole works had blown up. He then gave a very amusing account of his first entrance into the tunnel, carrying a pail filled with cartridges in one hand, his apparatus in the other, and the fuses on his person. All the miners were cleared out, and he proceeded to charge the holes, while the silence of the place was interrupted only by the plash of water trickling through the roof. When all the holes were filled, and the wires connecting them were ominously hanging out of the holes, resembling an exaggeration of rats' tails, a sense of anxiety and discomfort was unavoidable. Everything, however, went off satisfactorily, and the spark from the electric machine exploded all the cartridges. Until the men were drilled sufficiently to be safely entrusted with this business, the lecturer had to go in the tunnel every 8 hours, and 3 of the intervening hours were used up in preparing the charges. Five tuns of nitroglycerin were thus used per month; and for the same amount of rock blasted out, only 1 life was lost through nitroglycerin, where 30 or 40 were lost through gunpowder. It is safe to say that the Hoosac tunnel would never have been completed without nitroglycerin.

The lecturer then exhibited the electrical machine, contained in a neat keg. To this he connected 15 fuses and exploded them before the audience. The machine is a frictional one, its condenser having 450 inches of surface and the rubber being 6 by 8 inches. In practice, the fuses, instead of being close together as in the experiment, are attached to cartridges placed in holes from 6 to 12 feet apart, which they fill about two thirds or two fifths. As much as 6,000 cubic yards of solid rock have been blasted out at one discharge at Lake Champlain. The drill holes are made very deep, sometimes as deep as 50 feet. They are first gaged to make sure that they will receive the cartridges. Then the exploders are attached to the nitroglycerin cartridges, and these are immediately passed into the drill holes. The holes are next plugged with a bung, perforated to allow the delicate connecting wires to pass and to keep them away from the rock, by which the insulation would otherwise be destroyed. Finally, the wires are connected with the above-mentioned electrical apparatus, which is kept in a warm, dry room, and the explosions take place the moment the apparatus is charged.

Owing to the many fatal accidents resulting from the handling of Nobel's impure, dark-colored nitroglycerin, the manufacturers were obliged to substitute a modification for it, to which they gave the name of dynamite. This dynamite consists of a mixture of nitroglycerin and a kind of silicious or infusorial earth, "known under the various names of silicious marl, tripoli, rottenstone, etc." This earth absorbs the nitroglycerin without destroying it, and the result is a mixture which is no longer liquid and which can be transported with greater safety. Dynamite is only one of a large number of similar compositions of nitroglycerin. Mixed with sponge or other vegetable fiber, nitroglycerin becomes *porifera nitroleum*; with plaster of Paris, selenitic powder; with red lead, metalline nitroleum; with gunpowder in a fine state of division, lithofracteur or rend-rock; with sawdust, dualin. Dynamite, adulterated with nitrates of soda or potash, is sold as giant powder. These additions are manifestly adulterations, because they are converted into gases, so much more slowly than nitroglycerin that the power of the latter is considerably impaired. One might as well attempt to quicken the electric current by coupling it to the velocity of a locomotive. Give four men a weight to lift which requires the united force of all of them, the exertion of force by any one, later than that of the others, wastes the force of all.

Some of these compounds develop poisonous gases when they are exploded, and cannot therefore be used in tunnels without detriment to the workmen. In the Hoosac tunnel, when they were tried, the men would not pass through after the discharge until a train had re-established ventilation, but preferred to wait for several hours to go home.

Sometimes a diluted form of nitroglycerin is advantageous, provided its price is proportionate to that of the pure article. Where the rock is hard and tough, it is easier to bore holes an inch and a half than only an inch in diameter, because the drilling machine would soon batter up the thinner drill; on the other hand, a charge of nitroglycerin, diluted so as to fill up two thirds of the depth, would be much more effective than if it were concentrated at the bottom. This, of course, does not prove that these diluted compounds are stronger than pure nitroglycerin. At Hell Gate the trinitroglycerin was found to be six times as powerful as giant powder; and, as Professor Morton says, a mixture of $47\frac{1}{2}$ parts of infusorial earth and $52\frac{1}{2}$ parts of nitroglycerin cannot be coaxed to explode, and might be recommended as a good filling for fireproof safes.

There are several methods of estimating the power of explosive substances. According to the experiments by Nobel and Abel, if the gases developed by the explosion of 2·2 lbs. of gunpowder are confined in the volume of 61 cubic inches, they will exert a pressure of 6,400 atmospheres, and the explosion will disengage 705 calories. The experiments of Messrs. Roux and Sarran, of Paris, with nitroglycerin and gun cotton, gave 1,784 calories for the former and 1,123 for the latter. Hence, if the explosive force of gunpowder is taken as unity, that of nitroglycerin will be 2·53, and that of gun cotton 1·59.

M. Berthelot computes this force in a different manner. Taking 3,405 grains of nitroglycerin, he calculates that the elements composing it would produce an amount of heat equal to 430,500 calories, if they were transformed into water and carbonic acid: but the heat actually disengaged in making this quantity of nitroglycerin is 130,500 calories; hence the difference between the two figures, 300,000 calories, represents the total amount of heat which the 3,405 grains of nitroglycerin are still capable of developing. This makes 1,320 calories for each 15 grains.

There is one element which seems to have been ignored in these calculations, namely, the time in which an explosive is converted into gaseous matter. It takes a bullet one sixtieth of a second to reach the muzzle of a gun. A charge of gun cotton, in blasting a mine or in a rifle, explodes after the manner of gun cotton; but if fired by means of a suitable charge of fulminate of mercury, it goes off with extreme violence. Nitroglycerin soaked into blotting paper burns rapidly with a voluminous flame when lighted by flame, but detonates violently when spread on an anvil and struck with a hammer, or when fired by means of the initial explosion of a fulminate. Now, velocity of explosion is the very essence of disruptive force. This principle is lost sight of also in Mr. Nobel's method of testing explosives, which depends upon their projectile power. He puts them into a mortar and measures the distance to which they send a ball. Taking the ballistic force of nitroglycerin as 100, he finds for equal weights of other substances the following figures: Compressed guncotton, 71; dynamite (75 per cent nitroglycerin), 72; gunpowder with 20 per cent nitroglycerin, 50; fulminate of mercury, 30; strongest rend-rock, 50·5; Curtis and Harvey's powder (exploded with a fulminate), 28.

The mistake here is that substances like nitroglycerin, which, by their velocity of explosion, produce the best effect in blasting, are ill adapted to the propulsion of projectiles. They will burst the gun or expend part of their force in crushing the ball, and hence give indications much below their true strength. The real strength of nitroglycerin is probably 8 or 10 times that of gunpowder.

The explosion of nitroglycerin is so rapid and violent that the air above it has no time to move away, but acts like a solid; hence it will act downwards when placed upon the surface of a rock.

The lecturer, in the next place, put upon the table little heaps of dynamite, rend-rock, and mica powder, the latter being his own invention. He called attention to the fact that the mica powder burned with greater rapidity, and claimed that it was a more powerful explosive than the others. All the other compounds are made with a view to absorption of nitroglycerin by some inert substance; and when they are fired, there are two explosions, one of nitroglycerin on the outside of the particles of the infusorial earth, and another of that contained in the foraminiferous interstices. Hence there two weak blows instead of one strong one. In the mica powder, however, which consists of finely divided scales of mica, not more than $\frac{1}{4000}$ to $\frac{1}{1000}$ of an inch thick, moistened with nitroglycerin, there is no absorption, and the whole mass is exploded at once.

Mr. Mowbray then protested against the popular assumption that nitroglycerin cannot be prepared with sufficient purity to remain unchanged, to be safe to use, safe to transport, and safe to store. He has sent 1,000,000 lbs. of his pure limpid trinitroglycerin all over the country in teams, which jolted over rough roads, rolled down bluffs, and broke down; in trains which were thrown off the track; and in sloops which were storm-tossed.

He concluded by hoping that railroad and transportation companies would soon put an end to the clandestine transportation of nitroglycerin under feigned names, by appointing certain days for receiving it. C. F. K.

Hydrocarbons in Dynamite.

A Rhenish manufacturer of dynamite mixes 2 or 3 per cent of some hydrocarbon, like naphthaline, with the nitroglycerin employed. Two different sorts of dynamite are made, in which the following proportions are employed:

	1ST.	2D.
Infusorial earth	23	20
Chalk	2	3
Solution of naphthaline in nitroglycerin	75	70
Barytes	—	7
	100	100

A NEW printing ink is prepared by first dissolving iron in sulphuric, hydrochloric, or acetic acid. Half the solution is oxidized by means of nitric acid, after which the two halves are mixed, and precipitation is produced by oxide of iron. The precipitate is filtered, washed, and mixed with equal parts of tannic and gallic acid, which produces a black bordering on blue. The black is washed and dried, then mixed with linseed oil; and the ink obtained is suitable for either letterpress printing or lithography

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IMPROVED MIDDLINGS SEPARATOR

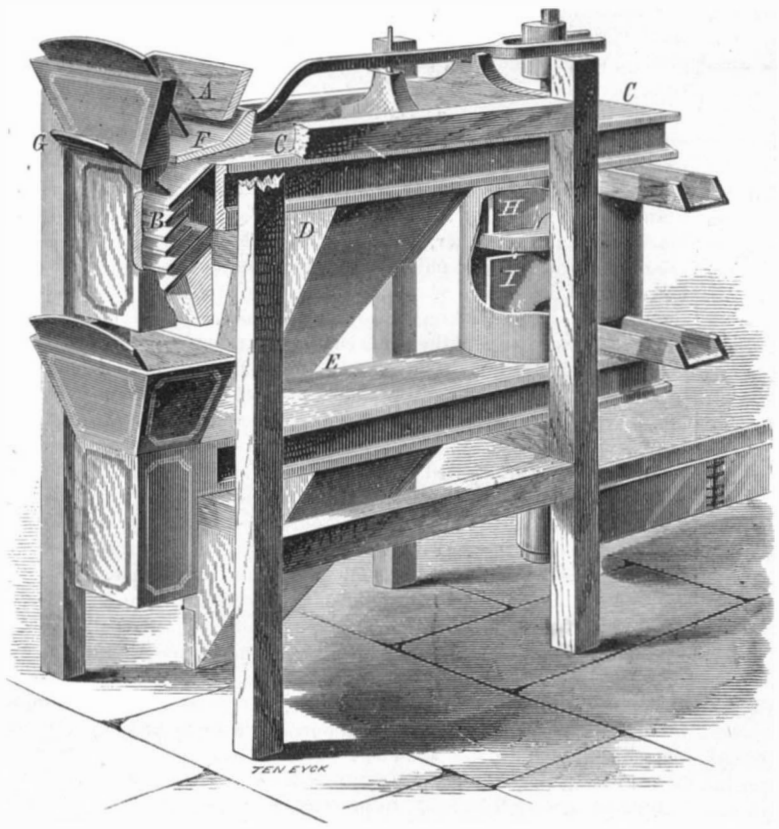
We illustrate herewith a new and simple middlings separator, in which descending streams of moldings are freed from impurities by the action of ascending air blasts.

In the upper part of a vertical draft box, A, are placed a number of inclined slats, B, which break and distribute the flow of middlings and the current of air. Said slats are located at the entrance of a horizontal box, C, along which the particles carried over from the vertical box are transported to the hopper, D, into which the final separation is made by a lighter current up the spout, E. The middlings are fed into box, A, from the hopper, shown above, passing upon a vibratory shoe, F, and their supply being regulated by the slides, G. The bran is discharged through the fan, H.

Below the apparatus thus described is arranged a duplicate set of mechanism in which the middlings falling from hopper, D, are again treated in the same manner by air currents set in motion by the fan, I.

The inventor informs us that he has practically tested the machine with excellent results. One has been in operation in the Oneonta Mills, Oneonta, N. Y., since September last, and has been examined and improved by prominent millers of the vicinity.

Patented March 14, 1876, through the Scientific American Patent Agency. For further particulars address the inventor, Mr. Morris N. Elwell, Oneonta, Otsego county, N. Y.



ELWELL'S MIDDLINGS SEPARATOR.

Artificial Grape Sugar.

The manufacture of glucose or artificial grape sugar from starch has become an important branch of chemical industry abroad, although in this country it is little developed, perhaps because potatoes are not so productive a crop here as there; and our starch is mostly made from corn, and hence is too expensive for profitable conversion into sugar, since any excess of corn is easily convertible into whisky.

Fr. Anthon has analyzed three specimens of grape sugar sirup, made in Bohemia, France, and Germany, respectively, with the following results:

	Bohemian.	French.	German.
Dextrose or grape sugar	48·3	30·1	50·0
Levulose or fruit sugar	6·2	5·0	——
Dextrin	25·5	48·0	——
Water	20·0	16·9	20·0

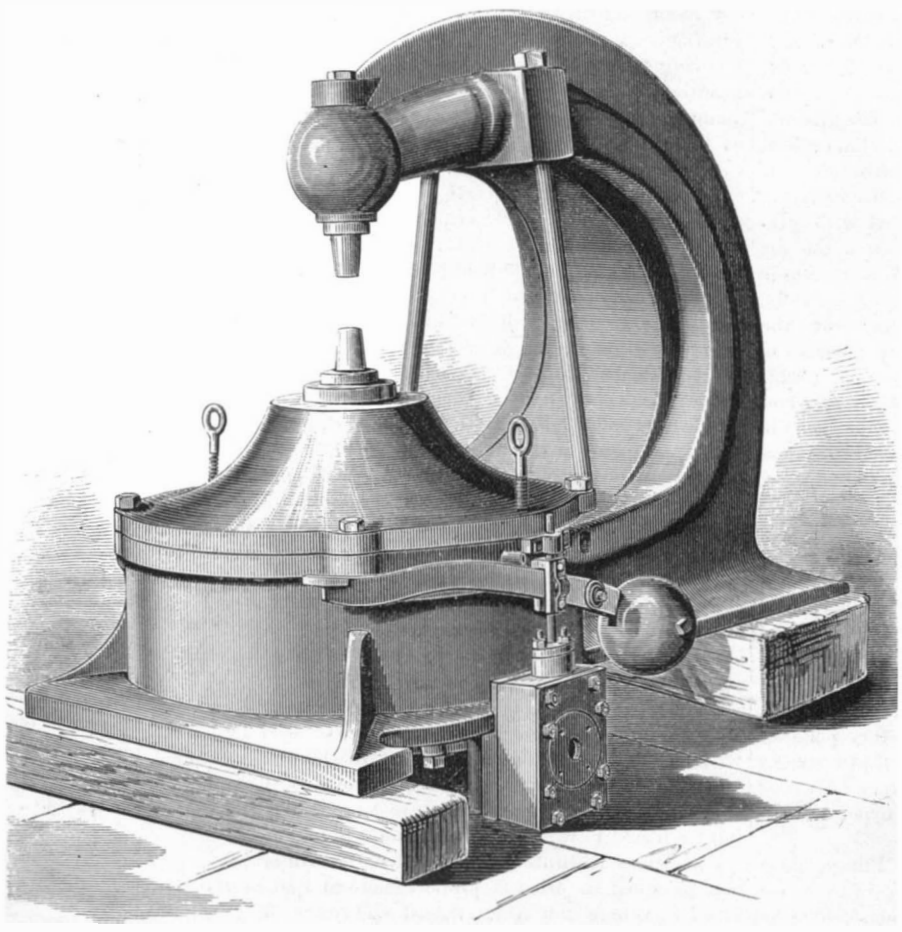
In the German sirup there was no dextrin, but 30 per cent of some substance soluble in alcohol, and not yet nearer determined.

IMPROVED STEAM RIVETER.

The annexed engraving represents a new machine for riveting together the angle bars, plates, and reverse bars that compose the frames, crossfloors, and keelsons of an iron ship. The parts are first bolted together temporarily, precisely as prepared for hand riveting, and are carried up to the machine by a large and suitably located crane. The rivets are heated in quantities, and are driven about as fast as a boy can put them in the holes prepared for their reception. The driving is done by direct steam pressure upon a large piston which moves vertically. Steam is admitted by the operator pressing the foot lever shown. When the pressure on the lever is removed, the weight on its end descends, and so causes the exhaust to open.

The machine, besides being applicable to the purposes of iron shipbuilding, is especially well adapted for the riveting together of the parts of iron railway bridges or of any work made up of angle, channel, or I beams, or of flat plates associated with them. The capacity of the apparatus, we are informed, is equal to that of ten gangs of hand riveters, and it requires the attention of but one skilled workman, three laborers, and one boy. The riveting, when done, is better than handwork, for the reason that the heavy direct pressure applied forces the heated rivet into every part of the rivet hole, filling it solidly, and this without granulating the iron, as is often the case with hand-driven rivets.

For further information address the manufacturers, Messrs. Pusey, Jones & Co., Wilmington, Del.



PUSEY & CO.'S STEAM RIVETING MACHINE.

Peter Cooper and the Locomotive.

Anything concerning the venerable Peter Cooper and the enterprises he has been engaged in is always interesting. The following account of the first locomotive and the reasons for building it, we find, says the *Iron Age*, in one of our exchanges:

"Mr. Cooper had bought, as a speculation, the entire magnificent tract in Baltimore now owned by the Canton Company. Baltimore was then a city of 75,000 people, rich and prosperous, and had entered upon the railroad era. On July 4, 1828, the corner stone of the Baltimore and Ohio road was laid with imposing ceremonies by Charles Carroll, of Carrollton. It was pushed energetically—a little too much so—for when thirteen miles had been finished it was found that, in turning the rocks to save cutting, such short curves had been introduced that the then experts declared the line utterly useless. It could not be used by steam. Five per cent had been paid in, and shares had been sold at 17, such was the zeal and confidence of the people. But the chill was immense, and everything stopped. Mr. Cooper, then 38 years of age, saw new disasters to himself in the depreciation of his tract should the road fail. He proposed to the directors to construct an engine to be available on their line They were willing, but incredulous. He brought down from his glue factory in New York an engine with a 3½ inch cylinder and 14 inch stroke, procured wheels and other appliances from the railroad company, and presently rolled out on the track the first American railway engine. The trial trip was to take place the next day. That night a thief stole all the copper and brass from the infant machine, and this caused some further delay. The trial trip was run, Mr. Cooper himself acting as engineer; and when the little baby locomotive threatened to lose too much steam, he held down the safety valve with his own hands. The run was made with 30 passengers, 13 miles in 1 hour, and Baltimore was happy. Compare the little engine of 47 years ago with the ponderous machines of to-day! and yet they follow on the pathway the little engine opened."

"We have heard the account substantially in the same form from Mr. Cooper himself. Several years since he was engaged in the construction of a steam yacht on the East river; and upon one occasion, when visiting it, we met him and had a long conversation on the subject of his early inventions and the little locomotive mentioned. Mr. Cooper went to and from the shipyard in a chaise drawn by one horse, and invited us to return with him. On the ride home he gave us some particulars of the locomotive. The draft was obtained by means of a small fan, and was sufficiently powerful to carry shavings from the firebox through the tubes and up through the smoke stack. The boiler itself was of the vertical tubular pattern. The engine was attached to a car in the usual manner. The importance of the success of the undertaking was very great to Mr. Cooper, as he, in partnership with two others, had bought a large tract of land near the line of the road. He found himself burdened with the whole purchase, as the others were unable to furnish their share of the money ; and in case of a fall in the value of the property, his loss would have been very heavy."

Useful Recipes for the Shop, the Household, and the Farm.

A new process for hardening zinc consists in pouring into the metal, while in a state of fusion, a proportion of sal ammonia varying from 3½ to 7 ozs. per 2·2 lbs. acocrding to the degree of hardness desired. Metal thus prepared can be worked with the file and the lathe, and may, in many cases, serve as a substitute for bronze

A new mode of waterproofing woolen materials consists in boiling 4½ ozs. white soap in 2½ gallons water. Separately dissolve 5¾ ozs. alum in 2½ gallons water. Heat these solutions to 190° Fah. and pass the fabric through the soap bath and afterwards through the alum solution. Dry in the open air.

To detect grape and cane sugar in glycerin Mix 5 drops of glycerin with 100 to 120 drops of water, 1 drop of nitric acid, and half a grain molybdate of ammonia, and heat. If sugar is present, the mixture turns to an intensely blue color.

Celebrated Automata.

The Philadelphia *Ledger* states that a Walnut street watchmaker, of that city, has recently had in his charge for repairs the famous automaton trumpeter made by M. Maelzel, which was exhibited in Philadel phia many years ago. The first public mention of the trumpeter was in the *Journal des Modes*, for 1809, at which time it was exhibited at Vienna, and attracted much attention. About 1830 M. Maelzel came to this country, bringing with him the trumpeter and also the chess player, another remarkable piece of mechanism, but which was not an automaton in the correct sense of the word, as its actions were controlled by a skillful chess player who was concealed within the figure.

The trumpeter was first exhibited on Fifth street, below Adelphi, in a building which stood where the Messrs. Tatham's building now is. Here Mr. Maelzel had a diorama of the burning of Moscow, which was a favorite entertainment. The universally known Signor Blitz, then a young performer, also appeared, and the trumpeter was exhibited by M. Maelzel, who would wheel it out on the floor, and touch a spring on the shoulder, which started the mechanism. He would then seat himself at the piano and play the accompaniments and variations, while the automaton played army calls, marches, etc.

After remaining on Fifth street for some time, M. Maelzel took his exhibition on a traveling tour, returning to Philadelphia Maelzel afterwards went to Havana, taking Signor Blitz and his automata with him here he was unfortunate, and, becoming dispirited and his health failing, he started for home, but died on shipboard, and his effects were sold to pay his passage.

A number of gentlemen, among whom were Dr. Mitchell, Constant Guillou, and Robert Cornelius, purchased the chess player, which was placed on exhibition in the Chinese Museum, at Ninth and Sansom streets, and was lost in the fire which destroyed that building. The trumpeter was placed in the old Masonic Temple, and passed into the possession of Mr. Scherer, a music dealer on Chestnut street, and is now owned by his heirs. The machinery of the trumpeter is contained within the trunk of the figure and is worked by a steel spring which drives a barrel on which are pegs like those in a musical box. A bellows just below the neck of the figure furnishes the wind, and a valve with a steel tongue, which is lengthened or shortened by means of levers working on the pegs in the barrel, makes the different notes.

RESIN 1 part and beeswax 1 part, softened with tallow, make a good grafting wax.

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IMPROVED SPOKE-SETTING MACHINE.

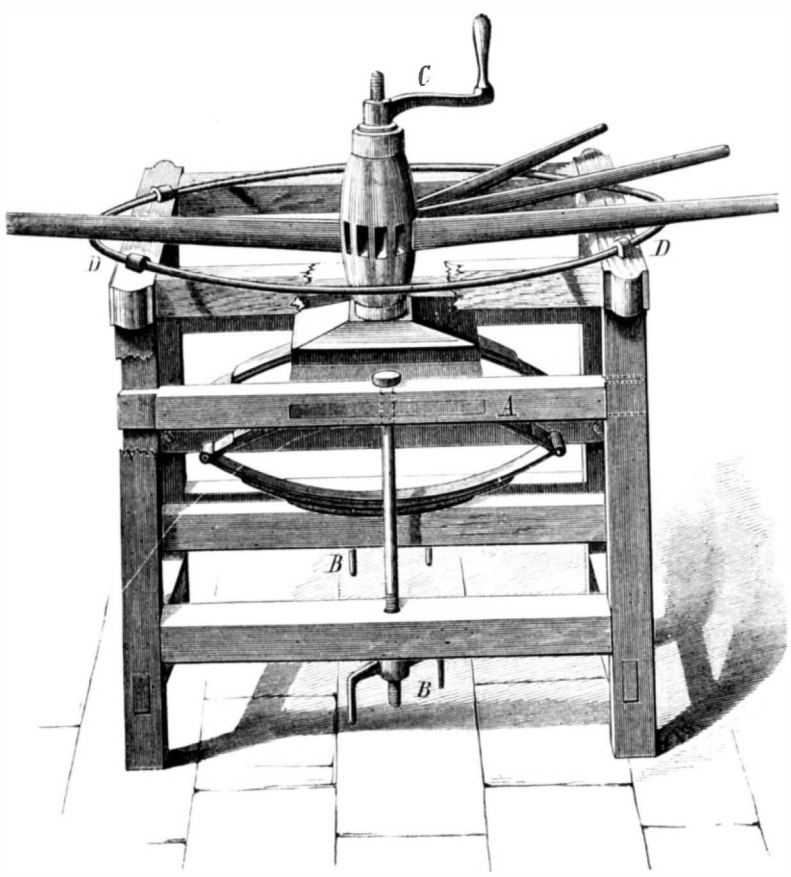
We illustrate herewith an improved apparatus for setting and driving spokes in a rapid and convenient manner, and in such a way that an exact inclination of all the spokes in a wheel is obtained.

A is an adjustable frame which is supported on springs, as shown, so as to be moved vertically by the bolts and crank nuts, B. The hub is placed on a central bolt, and is rigidly secured by a crank nut, C. Above the main frame is the guide or set ring, D, on which the spokes are placed while being set and driven into the hub.

After the hub is fastened in place, the adjustable frame, B, is screwed down until the center line of the hub is on a level with the circle. The hub is then dotted above the leveling straight edge, and the bolts are screwed down until the desired dish or set of the spokes is obtained. This is necessary, as all hubs are made with straight front and sloping back mortises, throwing the outer ends of the spokes forward at the same inclination. It now only remains to rest the spokes upon the guide ring, and to drive them into the hub.

The inventor claims the apparatus to be a valuable aid to the wheelwright, inasmuch as it can fill four wheels while one is being filled in the usual manner. It can easily be constructed by any good workman, and needs no skill for its manipulation. It sets all the spokes at one setting; and in driving, each spoke is tapped in turn until all are driven, thus protecting the brace between the mortises. Being adjustable, any length of hub can be filled. Finally, the machine is well suited for refilling wheels, as the set is got by the mortises and not by the end of the hub.

Patented through the Scientific American Patent Agency, March 25, 1876. For further information relative to sale of rights or machines, address the inventor, Mr. Thomas S. Morgan, New Columbia, Massac county, Ill.



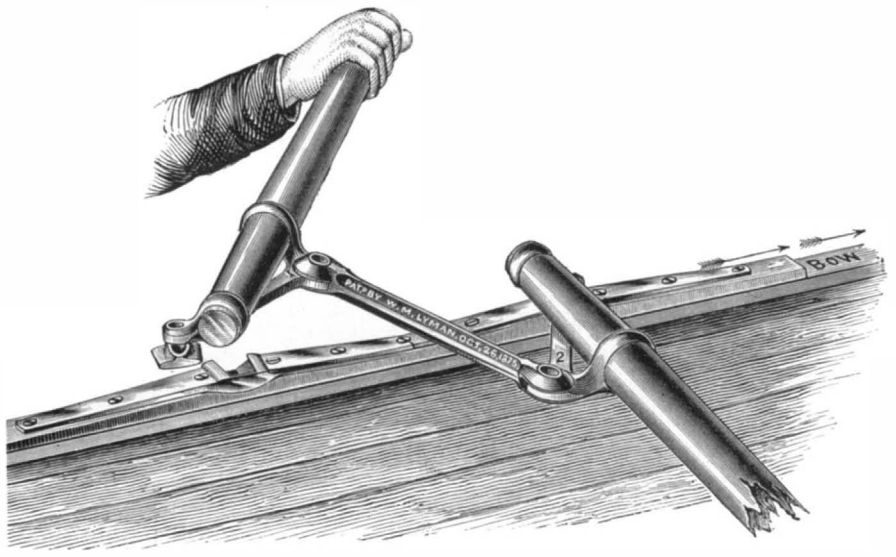
MORGAN'S SPOKE-SETTING MACHINE.

IMPROVED ROWING GEAR.

There are two cardinal objections to the present mode of propelling boats by rowing. The first is that the oarsman is obliged to travel backward and to rely upon occasional glances over his shoulder to direct his course, and the second is that his power is applied to the oar at a very decided disadvantage. The second objection is perhaps the most serious one of the two, inasmuch a sit is well known that, just at the most effective part of the stroke, the end, there is where the power is weakest and worst applied. A new device has recently been patented (October 26, 1875) by Mr. William Lyman, of Middlefield, Conn., which gets rid of both of these objections in a very simple and practical manner, and, besides, secures some other advantages which will tend to commend it to oarsmen generally.

Mr. Lyman cuts his oar in two, and secures each part in a separate iron, as represented in Fig. 1. Each iron has a ball and socket joint which connects to a button, and each button slips into a slot made in the metal facing of the gunwale, and is there secured by turning a pivoted catch. Lastly, the two parts of the oar are connected by a rod hinged to each iron at 1 and 2, Fig. 1.

A moment's consideration will show that when the handle of the oar is pulled in one direction, the blade of the oar will travel, not in the opposite direction, as is usually the case, but in the same direction. Consequently, when the oarsman, seated as in Fig. 2, facing the bow, pulls in the usual way, he propels his boat bow foremost, instead of backing her, as he would do had he ordinary oars. Again, the arrangement of the lever is obviously such that the



LYMAN'S ROWING GEAR.—Fig. 1.

Fig. 2.

strength of the rower is applied to excellent mechanica advantage, enabling him to pull a stronger stroke and to keep it up much longer than would otherwise be possible. Steering is also rendered much easier, and the catching of crabs is avoided through the oarsman seeing his blade at the beginning of the stroke. The parts of oars can easily be folded together for transportation, or may be closed up along the side of the boat, without detaching them from the gunwale, when not in use. A pair of the oars thus arranged weighs about five pounds more than ordinary oars, but this additional weight, it is claimed, has the advantage that, at the beginning and end of the stroke, it helps to lower and raise the blade, owing to the peculiar position of the oar.

The inventor informs us that last summer he rowed some 400 miles with this gear, spending his vacation in the Adirondacks and the Thousand Islands, and ending his cruise by a row down the Connecticut river. The oars will be found on exhibition at the Centennial.

For further information, etc., address the inventor as above. The patents for foreign countries are for sale.

Underground Telegraphy in New York City.

The Western Union Telegraph Company have begun the work of laying the telegraph wires in this city underground. Experimental sections, made of iron pipes of a capacity of 125 wires each, are being placed in position, between the Cotton Exchange, the Telegraph Company's buildings, and other points. At the same time, pneumatic tubes for the transmission of written messages by the air blast are also being located on the line of the telegraph pipes. The pneumatic tubes are made of brass.

It is greatly to be hoped that this system of underground telegraphy may be extended throughout the whole city, to the exclusion of the present unsightly poles. That the plan is fully practicable has been amply demonstrated in London and other European cities.

The Discoverer of Bromine.

SCIENCE in general, and photography in particular, has just suffered a considerable loss in the death of M. Balard, who died recently in his 74th year. The illustrious chemist, to whom we owe the discovery of bromine, succeeded Baron Thénard in the professional chair in the Faculté de Sciences, in 1844, and Darcet as member of the Academy. He replaced Pélouse in the College de France, in 1851. M. Balard was President of the French Photographic Society, where his zeal for the new art, his great attainments, and his charming urbanity, won the respect and affection of all

Spontaneous Combustion.

"Yesterday, about three o'clock, a disagreeable odor was observed in and about R. H. Delmage's carpenter shop; a search was immediately instituted, and smoke was discovered issuing through a small crack in the floor, but in such a thin vapory state that it was at first taken for dust; a more careful examination revealed the fact that it was really smoke. There being no other means of access, the floor was immediately torn up, when it was found that sawdust had accumulated to the depth of some five or six inches, and of course some saw filings and other *débris* had become mixed with the sawdust; this combination was thoroughly saturated with boiled linseed oil, which had leaked from a large can placed immediately above it; from this mass the smoke was issuing, and further examination verified the startling conjecture that beneath the surface this composition was all on fire and was actually in a charred state. The surface was entirely unbroken, and smoke oozed slowly out, something as from a coal pit. There was no means of ingress to render it possible to have been the work of an incendiary, and no possible means of the fire in any way having come from above. The only solution of the matter seems to be that it was a case of spontaneous combustion. Mr. R. H. Delmage, the owner of the shop, is a man whose veracity will not be questioned, and, besides, we have the same facts attested by several others who are among the most reliable and intelligent men in this community. Here, now, is a question for scientists. Will a combination such as the above generate fire? If so, the sooner that matter is settled the better. But for the timely discovery, great damage would certainly have been the result.—*Afton (Iowa) Tribune*, May 4.

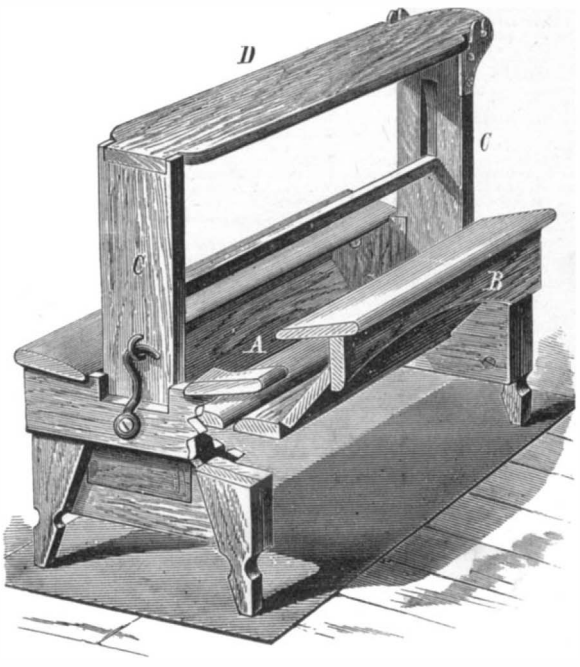
[We would inform our cotemporary that it is very well known that a combination of oil and combustible materials, such as that above described, will produce spontaneous combustion. Many such examples have been recorded in the pages of the SCIENTIFIC AMERICAN.—EDS.]

Purification of Sulphide of Carbon.

Instead of the usual method of purification with mercury salts, S. Kern recommends the nitrate of lead, pulverized and mixed with a little metallic lead. The bisulphide is shaken with fresh quantities of the salt as long as it continues to blacken it; then it is decanted and distilled. The affinity of lead for sulphuretted hydrogen and sulphur in general leads us to believe that Mr. Kern's method will prove a good one. Strips of bright metallic copper will also soon remove the color and much of the odor from bisulphide of carbon. Unfortunately exposure to light causes both odor and color to return.

WHITE'S IMPROVED WASHTUB STAND.

Housekeepers will, we think, be pleased with the new invention herewith illustrated, which is intended as a useful convenience for the laundry. It combines a hollow stand in which clothes may be kept until the arrival of wash day, an arrangement for supporting washtubs, and an ironing board. The clothes are placed in the receptacle, A, and the inclined opposite ledges, B, serve to receive the tubs. C C are hinged sections which sustain the ironing board, D. The latter fits between two studs at one end, and has at the other two side pivots that enter into section bearings, one of which is open to permit the ready removal of the ironing board when not required for use. The hooks shown on the ends of the stand also serve to hold the sections, C, in vertical position. By closing the sections, C, and placing the ironing board on the stand, a very good bench is formed. The



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apparatus can be cheaply made, and, the inventor states, can be sold at large profit.

Patented through the Scientific American Patent Agency, March 21, 1876. For further information relative to salo ef rights, etc., address the inventor, Mr. John J. White, 279 Church street, Norfolk, Va

DECISIONS OF THE COURTS.

United States Circuit Court—Western District of Michigan.

PATENT PHOTO-PLATE HOLDER.—SIMON WING, ALBERT S. SOUTHWORTH, AND MARCUS ORMSBEE *vs.* JOSEPH H. TOMPKINS.

[In equity—Before Withey, J. Heard January 25, 1867. Decision April 5, 1876.]

WITHEY, J.:

Letters patent were issued to Albert S. Southworth, April 10, 1 55, which were surrendered and canceled—and September 25, 1860, upon amended specifications, re-issued letters were granted for a new and useful plate holder for cameras. The claim is "bringing the different portions of a single plate, or several smaller plates, successively into the field of the lens of the camera, substantially in the manner and for the purpose specified." In describing his invention the patentee, in his specification, states that it had "been customary to use a separate plate for each impression, the plate being removed from the camera and replaced by another; where several impressions of the same object were to be taken, as in multiplying copies, or for the purpose of selecting the best timed pictures, this caused considerable time and trouble, to obviate which is the object of my present invention."

Complainants are assignees of the patentee, and it is admitted if the patent is valid that defendant has infringed. The only question I have occasion to examine and decide is whether the patentee was the first and original inventor. Incidentally the question is raised of abandonment.

It is insisted that the evidence shows Southworth to have conceived and perfected his invention as early as the winter of 1847-8, if not earlier. And it is shown that in 1861 the validity of the patent was declared, Wing *vs.* Richardson, 2d Fisher's patent cases 535; also that there have been sixteen other decrees upholding the letters patent, not all contested cases, however.

On the other hand it is claimed that the proofs show the patented improvement of a sliding plate holder for cameras was known and practised by photographers as early as 1847 or 1848, and that the patentee did not perfect his invention until the fall of 1854, long after the machine was in use by others: That in 1869, Mr. Justice Nelson, in Wing *vs.* Schoonmaker, 3d Fisher's patent cases 607, held the patent invalid. The last case was appealed to the Supreme Court of the United States, which court was equally divided, four of the judges for and four against the patent.

But one case, it is said, has since been decided: Wing *vs.* Dunshee, in the United States Circuit Court for the District of Massachusetts, not reported, in which the previous ruling in that circuit by Mr. Justice Clifford in the Richardson case was followed. The last reported case is that against Schoonmaker, holding the patent for a sliding plate holder invalid, and in which there was apparently important and material testimony not put into the case against Richardson, decided eight years earlier. Presumptively, this would account for the different judgments of the two eminent judges.

In considering the additional testimony in this case, I have necessarily been led to examine the evidence in previous cases, stipulated into this. Briefly, Southworth's patent, owned by complainants, rests upon the fact that one Coburn, in 1846, made for the patentee a camera box, having wings on its side, in which a sliding plate holder could be placed, but no plate holder was made or used in connection with it, or otherwise. The camera was found to be too expensive, and was discarded. Then Southworth had one Stewart make a sliding front to a camera, by which he moved the lens over the plate on which impressions were taken at any desired point; but this process in multiplying pictures on one or more plates required either the camera or sitter to be moved at each separate impression taken, and was in my judgment far from being identical in principle with the sliding plate holder, by which pictures may be multiplied on one or several plates without moving the camera, the sitter, or object.

Nothing further was accomplished by Southworth in perfecting the idea which he evidently had, of multiplying pictures by some sort of an adjustable plate holder, and which he seems to have abandoned when he discarded the Coburn camera, until 1854, sometime after his return from California. In 1849 he went to California and remained nearly two years, till January, 1851, during which time he worked in the mines and gave no attention to the art of photography. When he returned to Boston he experimented some time in reference to the stereoscope, and was in poor health, altogether occupying him till the fall of 1854. In this time he perfected and took out or got or more patents for the stereoscope. In the fall of 1854 he had the varioloid, confining him to his room for more than two weeks, and then again he turned his attention to the adjustable plate holder. During that fall he perfected his invention and applied, in December, for and obtained a patent, April, 1855. Southworth states, as a reason why he did not earlier make application for the patent, that he had not perfected the mechanical parts to his satisfaction, so as to carry out his idea readily. Then the California excitement came on, and he followed others to the land of gold.

After he was taken with the varioloid in the fall of 1854, he says, he shut himself up in his room, and "I applied myself to this idea of taking pictures rapidly in the center of the lens by adapting the movement in a frame which would fit any ordinary camera." This view of the progress of his invention is not substantially changed by any subsequent testimony, and in my opinion dates his invention of a movable plate holder in the fall of 1854.

This was the judgment of Mr. Justice Nelson in the case against Schoonmaker, in 1869, and in which I fully coincide.

Southworth testifies again in Wing *vs.* Anthony, in 1874, stipulated into this case. On his cross examination he says: "I think I used the sliding plate holder in a camera as early as 1852." For him to swear to what he thinks he did in 1852, does not establish any fact. It is too late to change ground as to the time of his invention, unless the proofs are stronger than anything before me.

It may be worthy to notice in this connection that if Southworth perfected his invention in 1846-7 or '48, and did not apply for a patent until the spring of 1855, there would seem to be a grave question whether he had not by laches abandoned to the public what he had invented. He makes a faint showing of ill health and want of pecuniary means during some part of the interval, but he had health to visit California and there engage in digging for gold for about two years. After his return he had health enough and money enough to engage "in considering new ideas, new plans, and new inventions relating to the stereoscope and other things connected with our (his) business, studying upon and taking out patents," before he turned his attention to applying for his patent.

If it had not been said in Wing *vs.* Richardson that there was no abandonment, because the reasons assigned—poor health and want of pecuniary means, excused want of diligence—I should be disposed to say that the six or seven years' delay was fatal to the validity of this patent. The point is raised in this case, but I need not rest my judgment upon it.

The next consideration is whether the sliding plate holder, for multiplying pictures on one or several plates, had been known and used in cameras prior to 1854, and if so, when. I make but brief reference to testimony.

The testimony of W. A. Pratt, taken December, 1873, in the case of Wing *et al vs.* Tompkins, is quite satisfactory on the point, corroborated as he is in material portions of his statements.

He says he invented the sliding plate holder at Alexandria, Va., in 1845—presents a model of it and pictures taken by that method—four on one plate, of his son, on his birthday, with the date of taking, at Richmond, Va., endorsed on the back of the plate at the time, "March 6th, 1847."

He opened a gallery at Richmond in 1846. On his sign were the words: "Virginia Daguerrean Gallery, established 1846;" here he made many thousand pictures for sale, by this method of the sliding plate holder. He thus made pictures of the members of the Constitutional Convention of Virginia, in 1850-1—names several members whose pictures were taken—also members of the legislature of that State in session in 1850-1. He explained his method of multiplying pictures to others; among them, one N. P. Simons, who testifies to the same fact, and that he used the method in taking impressions. The camera and plate holder used by Pratt were burned at Richmond in the great fire of 1865, hence they are not produced.

William Stroud learned of the movable plate holder and process for multiplying pictures on one plate, at Philadelphia in 1852, and in that year used a camera and adjustable plate holder in multiplying pictures.

He fixes the time by a bill rendered for poplar boards used in his gallery in making a revolving platform for taking stereoscopic pictures by this method, bearing date December, 1852, made an exhibit in this case. He also produces a leaf from his daguerrean register, in which, under date of August 11, 1852, is an entry of pictures which were taken by this method. One of the pictures is made an exhibit. He also produces the camera and sliding plate holder used by him in taking and multiplying these and many other pictures.

I pass over other testimony of prior use of complainant's patented invention, remarking, however, that the evidence to discredit the testimony of Pratt, and to show that certain exhibited pictures could not have been taken in the center of the focus of the lens, nor by the patentee's process and plate holder, is fully met by the testimony on behalf of defendant on the same subject.

Satisfied, as I am, upon both of the topics discussed, that the patent is invalid, I have no hesitation in so ruling. My judgment is supported by that of Mr. Justice Nelson, in Wing *vs.* Schoonmaker, in which that learned Judge said: "The proofs are full that the idea of making the same impression on different parts of the same plate by the use of a sliding plate holder existed and was carried into practical operation by working machines as early as 1847-8, and was in use by several practical photographers, some seven or eight years before the date of the patent of Southworth, and before he had perfected his machine."

There has been no ruling in this circuit upon this patent, so far as I know. This fact, taken in connection with the different judgments in Wing *vs.* Richardson and Wing *vs.* Schoonmaker, eight years apart, and upon somewhat different facts, leaves me at liberty to follow my own judgment, and especially so in view of the additional testimony put into this case.

A decree will be entered for defendant.

United States Circuit Court—District of Massachusetts.

BOSTON ELASTIC FABRIC COMPANY *vs.* EAST HAMPTON RUBBER THREAD COMPANY.

[In equity.—Before Shepley, J.—Decided October term, 1875, to wit, April 4, 1876.

SHEPLEY, J.:

A former suit between these parties commenced for alleged infringement of letters patent granted to Liveras Hull, dated January 20, 1863, for an improvement in cutting sheets of rubber into threads, was dismissed upon the ground that the patent, as it then stood, was for a machine, and that the machine used by Hull was substantially the same machine as one of prior date know to manufacturers of rubber thread as "the bottle machine."

Since the decision in that cause, the patent has been reissued to the complainants, as assignees of Liveras Hull, by reissue 5,908, dated June 2, 1874, as a patent for an art or process, the claim being "for the improved mode of manufacture, consisting in cutting the sheet into a series of threads by a continuous cut of one cutter," as described in the specification.

At the hearing of the former cause it clearly appeared that Liveras Hull without any knowledge of any prior machine, or of any prior use of an art of cutting rubber threads in the mode described in his specification, had invented both the machine and the mode of manufacture. But it also appeared as clearly that there was proof of a machine of an earlier date than his invention, although it was unknown to him.

It did not quite satisfactorily appear, from the evidence in the former case, that the process or mode of manufacture described by Hull, and now, but not then, claimed, had been practised on the anticipating machine, although that mode of manufacture could have been practised on that machine, or at least on one differing from it only in the enlarged size of the drum on which the sheet rubber is wound. There was no conclusive evidence in that case that Hull was not the first, as he undoubtedly was in one sense an original, inventor of his mode of manufacture. But this issue was not directly involved in that case, the patent, as it then stood, being for the machine, and not for the art or process. Evidence has now been introduced, much of it coming from witnesses who were not examined before, which seems to prove satisfactorily that a machine was constructed by one Helm during the fall of the year 1860, and completed before the 1st of January, 1861; that a sheet of rubber, many yards in length, was wound round and round upon the drum of said machine; that the machine had a single circular cutter which was pushed up to the drum through the rubber at one end of the cylinder; that the drum was then caused to rotate slowly, and the circular cutter to rotate rapidly, and at the same time to traverse slowly along the face of the drum until it reached the other end of the drum, by which operation the sheet of rubber was cut into a series of threads by a continuous cut of one cutter.

That this was the same process claimed and described in complainants' patent is too clear to admit of dispute. Complainants contend that the process was only imperfectly carried on, that the thread made was imperfect, and that the use of the Helm machine was merely experimental, and the experiment was abandoned before Hull made his invention.

The law upon this subject is too well settled to require the citation of any authorities.

A patent may be defeated by showing that the thing secured by the patent had been invented, and put into actual public use, prior to the discovery of the patentee, however limited such use (other than experimental) or knowledge of the prior discovery may have been.

Seven witnesses, who are unimpeached and uncontradicted, testify to the public and practical, not merely experimental, use of the patented process, in New Brunswick, on the Helm machine, prior to the time of the alleged invention by the patentee. They prove that the threads cut by that machine were good marketable threads, well cut, and publicly made and used in large quantities in the manufacture of both shirred goods and suspenders, and that the fabric made from them was a good salable fabric and regularly sold in the market. There is some conflict in the testimony as to the subsequent history of the Helm machine on which this was first cut by the patented process. That history is not material to this inquiry. We are dealing with the mode of manufacture of the thread. The evidence shows that mode of manufacture to have been practised, not for experiment, but in the regular course of business, openly, successfully, and practically, within the knowledge of a large number of persons at a time prior to the date of the alleged invention.

Bill dismissed.

[*James E Maynadier*, for complainants.
George Gifford, *Hillard*, *Hyde*, and *Dickenson*, for defendants.]

United States Circuit Court—District of Massachusetts.

HELEN MARIE MCDONALD *vs.* S. M. BLACKMER *et al.*

[In equity.—Before Shepley, J.—Decided October term, 1875, to wit, April 4, 1876.]

SHEPLEY, J.:

Since the disclaimer, which was filed before the date of the bill in this case, the claim of the complainant is limited to that only which was described in the specification of her patent, namely, "as a new article of manufacture, a skirt protector, having a fluted or plated border bound with or composed of enameled cloth or other waterproof material," I see no reason to doubt that she was the first and original inventor of this article, as distinguished from a skirt facing, which is an entirely different article, and from a skirt protector, which, being made of wiggan or similar material, was substantially useless for the purpose, as compared with the complainant's invention.

Decree for injunction and account, as prayed for in the bill.

[*George E. Betton*, for complainant.
Browne and *Holmes*, for defendants.]

United States Circuit Court—District of Massachusetts.

PATENT GAS APPARATUS.—THE GILBERT AND BARKER MANUFACTURING COMPANY *vs.* THE WALWORTH MANUFACTURING COMPANY.

[In equity.—Before Shepley, J.—Decided April 4, 1876.]

SHEPLEY, J.

The complainants are the owners of letters patent of the United States, dated August 3, 1869, No. 93,268, for an improved apparatus for carbureting air. The invention is described in the specifications as relating to the apparatus used for carbureting air in the manufacture of illuminating gas for dwelling houses and factories, and as consisting in the arrangement of the carbureter with the meter wheel or pump for driving the air through said carbureter to the burners, and the coil and heating pipes for evaporating the oil within the carbureter, whereby the whole apparatus is rendered perfectly safe with regard to life and property in the building lighted, the carbureter being situated in a vault or house away from the building to be lighted, while the heating apparatus and the pump or meter wheel are within the building to be lighted, and where they can be easily and quickly reached, and under perfect control of the occupant of the house. There was nothing novel in the meter wheel, or the carbureter, or the combination of a meter wheel with a carbureter, or their connection with the gas pipe, air, or heating pipes, except so far as their location and arrangement was claimed to be new, by placing the carbureter in a vault or house by itself, separate from the building to be lighted, and arranging the meter wheel and the heating coil in the building to be lighted where they could be easily reached, and under control of the occupant of the house without exposure to explosion consequent upon frequent access to the room in which the carbureter is placed, and connected by pipes passing through a wall or the ground, so as to cut off any communication of gas or flame between the room in which the carbureter is placed and the building to be lighted.

It is denied on the part of the defendants that there is any patentability in such a change of location of parts, all of which are confessedly old. Mere change of location is not patentable; but where change of location brings into existence a new combination of devices operating by reason of such new combination to produce a new and useful result, such new combination is patentable. (Woodruff, J., in Marsh *et al. vs.* The Dodge Stevenson Manufacturing Company, 3 *Official Gazette*, 398.)

I am not prepared to say that the new arrangement and location constituting a new form or mode of combination, as described in the patent, taking into consideration the new and useful result claimed for it, was not patentable, if it was novel at the time claimed as the date of plaintiff's invention.*

Without instituting a comparison between the patented invention and all the other prior existing forms of apparatus for carbureting air for illuminating purposes, which have been proved to have existed, I have selected the Meriden machine for the reasons that it is proved to have been constructed and operated successfully in the fall of 1864, while the invention of Gilbert & Barker is not even claimed to have been before June, 1867, and also because this apparatus appears to me to have embodied in 1864, in successful and and practical and public use, every element of the first claim of the complainants' patent of August, 1869.

The Meriden apparatus was used for carbureting air for illuminating a factory. It consisted of an air pump and air receiver, a well known equivalent for the meter pump wheel, a carbureter, the equivalent of complainants' carbureter, placed in a brick vault built on the surface of the ground ninety-three feet from the main building to be lighted. This was actually both a vault and a house, and therefore identical with complainants' vault or house. There was an air pipe, which connected the pump inside of the building to be lighted with the carbureter in the vault, passing underground and furnishing a conduit from the air in the pump to the carbureter, being thus the equivalent of complainants' pipe A. There was a gas pipe leading from the carbureter in the vault through and underground, and furnishing a conduit for the carbureted air or gas from the carbureter to the building to be lighted. This is identical with complainants' pipe N. There was also a steam pipe with its connections, but that is not material to the inquiry involved in this case, because the defendants do not use any artificial heat, and the complainants do not make their heating coil and pipes a part of the arrangement and combination claimed in the first claim.

The Meriden apparatus contained every element of location, arrangement, and combination claimed in the first claim of complainants' patent.*

There are many other references to the patent and the drawings, and other comparisons between the described inventions and arrangements other than those of the Meriden apparatus which might be made confirmatory of the views I have taken; but those already stated are so conclusive to my own apprehension, that further illustration would seem to be superfluous. It follows that the bill must be dismissed.

Bill dismissed with costs.

[*E. W. Stoughton* and *William Stanley* for complainants.
Causten Browne and *Jabez S. Holmes* for defendants.]

NEW BOOKS AND PUBLICATIONS.

ARCHITECTURAL IRON WORK, a Practical Book for Iron Workers, Architects, Engineers, etc. With Specifications for Iron Work, Useful Tables, and Valuable Suggestions. By William J. Fryer, Jr. Illustrated. Price $3.50. New York city: John Wiley & Sons, 15 Astor place.

This book is the best specimen which has reached us of a new trade literature which is now springing up to answer a demand created by the extensive use of iron in architecture, not merely for tie rods and girders, but as a building material. The author is evidently thoroughly acquainted with his subject, and his book is an exhaustive treatise on the science and art of building in iron. The specifications are admirably drawn, and the tables of proportions, weights, and loads for iron work of all kinds are full and complete. The book is well illustrated, and is a clear, practical treatise, adapted for workmen and owners of buildings as well as for the engineering profession. It is, moreover, free from those technical expressions which too often impair the value of such works for practical workmen.

VILLAS AND COTTAGES, OR HOMES FOR ALL: Plans, Elevations, and Views of Twelve Villas and Ten Cottages, Suited to Various Wants and Locations. Designed by William L. Woollett, Fellow of the American Institute of Architects. Price $3.00. New York city: A. J. Bicknell & Co., 27 Warren street.

Judging from the number of books on villa architecture which reach us, there must be a lively demand for rural and suburban residences just now; and it is gratifying to observe the increasing neatness and propriety of design which characterize them, and the gradual disappearance of the grotesque and clumsy attempts at ornamentation which disfigured the homes of the last generation. In internal convenience and sanitary arrangement, there is also a marked improvement. Mr. Woollett's designs, shown in 40 well executed plates, fully justify the above remarks, being marked by good taste and ample provision for supply of light and fresh air. The brick buildings illustrated in this book are especially commendable for the substantial and effective use of this material, which is in most respects the best ever employed in building human habitations.

CHEMISTRY, THEORETICAL, PRACTICAL, AND ANALYTICAL, as applied to the Arts and Manufactures. By Writers of Eminence. To be completed in Forty Parts, price 50 cents each. Philadelphia, Pa.: Lippincott & Co., 715 and 717 Market street. For sale by James Sheehy, 33 Barclay street, New York city.

This book, says the title page, is constructed on the basis of the late Dr. Sheridan Muspratt's "Chemistry as applied to the Arts and Manufactures;" and it is to that widely circulated work that the new publication, an instalment of which is now before us, owes its chief recommendation. There is, however, some new matter in it, and the modern notation is introduced. The work would be more readily adopted as an authority if the names of the "writers of eminence" were given. A work of this magnitude ought not to be published anonymously.

ANNUAL REPORT OF THE UNITED STATES GEOLOGICAL AND GEOGRAPHICAL SURVEY OF THE TERRITORIES FOR 1874. By F. V. Hayden, United States Geologist. Washington, D. C.: Government Printing Office.

Professor Hayden is engaged in a work of national importance, and is carrying it out in a thoroughly efficient manner. In his account of his labors during 1874, he describes the topography and geology of Colorado and some parts of the adjacent territories; and the botanical and palæontological features of the country explored have not escaped observation. The work now being done by the expedition is an immense one; and a perusal of one of Professor Hayden's reports enables us to fully appreciate it. The book is well and liberally illustrated, the photographers who travel with the expedition being constantly at work as the party progresses.

LADIES' FANCY WORK: Hints and Helps to Home Taste and Recreations. By Mrs. C. S. Jones and Henry T. Williams. Price $1.50. New York city: H. T. Williams, 46 Beekman street.

This is the third of a series of useful volumes which the above named publisher is issuing, with the design of collecting, in permanent form, an immense number of hints and suggestions relative to tasteful household ornamentation, some of which, hitherto, have appeared in family newspapers, while others have been known only to few individuals. The present book tells how to make fancy work of all kinds, including paper and wax flowers, shell, leaf, and moss ornaments, bead and worsted work, and the thousand knick-knacks of ribbon and cardboard which ladies delight to manufacture. It is copiously illustrated, handsomely bound, and the descriptive matter is plain and easily followed.

ENGINEER'S AND MECHANIC'S POCKET BOOK. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer, etc. New York city: Harper & Brothers, Franklin Square.

Mr. Haswell's engineer's pocket book has been before the mechanical public now for over thirty years, so that there is little necessity for here recapitulating its contents. It is one of the best, if not the best, of handy books of reference extant; and it must be a matter of some difficulty to suggest any useful practical facts or tables which are not to be found somewhere among its 700 pages. The present edition is the thirty-second, and is fully up to the times, through fresh and careful revision of the contents. It is strongly and handsomely bound in leather, in pocket book form, and can be obtained, postpaid, by mailing $3.00 to the author, at 6 Bowling Green, New York city.

CATALOGUE OF THE FISHES OF THE BERMUDAS. By G. Brown Goode. Washington, D. C.: Government Printing Office.

This work is one of a series intended to illustrate the natural history collections constituting the National Museum, which were entrusted to the care of the Smithsonian Institution by Act of Congress in 184

CENTENNIAL COLLECTION OF NATIONAL SONGS. Price 40 cents. New York city: C. H. Ditson & Co., 711 Broadway.

A collection of songs, more or less familiar, which will probably be welcome to many people in this year of celebrations.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 28 to April 24, 1876, inclusive.

AIR BRAKE, ETC.—Empire Vacuum Brake Company, New York city.
AIR GUN, ETC.—A. A. Pope, Boston, Mass.
AIR PISTOL.—A. C. Carey, Malden, Mass.
BATH TUB.—A. Seligsburg, New York city.
BENDING TUBE PLATES.—S. P. M. Tasker, Philadelphia, Pa.
BENDING TUBES, ETC.—C. Scofield, Vineland, N. J.
BINDING SHEAVES.—S. Johnston, Brockport, N. Y.
BOOT, ETC.—R. S. Manning, Trenton, N. J.
BOOT-LASTING MACHINE.—F. S. Hunt, Lynn, Mass.
BOOT-SEWING MACHINE.—C. Goodyear, Jr., New York city.
BRISTLE-DRESSING MACHINE.—E. B. Whiting, St. Albans, Vt.
CAKE MACHINERY.—G. W. Nelson, New York city.
CARTRIDGE ANVIL.—J. Saget, New Orleans, La.
CHAIR.—W. T. Doremus, New York city.
DENTAL APPARATUS.—H. C. Howells, Flushing, N. Y.
ELASTIC SEAM.—J. Bigelow, Boston, Mass.
ELECTRIC ENGRAVING MACHINE.—J. C. Guerrant, Danville, Ill.
ENGINE VALVE.—E. Purvis, New York city.
FEED WATER HEATER.—H. N. Waters *et al.*, West Meriden, Conn.
GAS APPARATUS.—W. H. St. John, New York city.
GAS METER.—J. Morgan, New Orleans, La.
GAS STOVE, ETC.—C. F. Brooker, Wolcotville, Conn.
GRAIN CONVEYER.—N. G. Simonds, Boston, Mass.
HOOF EXPANDER.—C. H. Shepard, Elizabeth, N. J.
HORSESHOE NAIL, ETC.—J. B. Wills, Keeseville, N. Y.
INJECTOR.—J. Fergus, Philadelphia, Pa.
MACHINE GUN.—F. L. Bailey, Indianapolis, Ind.
MAGNETIC MACHINE.—J. B. Fuller, New York city, *et al.*
MANGLING APPARATUS.—W. G. Lewis, Framingham, Mass.
MASHING GRAIN, ETC.—R. d'Heureuse, New York city.
MINING MACHINE.—F. M. Lechner *et al.*, Columbus, Ohio.
OBSERVATORY.—L. B. Sawyer, Boston, Mass.
PAPER BOXES, ETC.—S. Wheeler, Albany, N. Y.
PAPER-CUTTING MACHINE, ETC.—W. Scott, Chicago, Ill.
PIPE NOZZLE, ETC.—M. Clemens, Worcester, Mass.
PLAYING CARDS.—I. N. Richardson, Malden, Mass.
PRESERVING FABRICS, ETC.—W. Thilmany, Cleveland, Ohio.
PYROTECHNIC SIGNAL.—E. F. Linton, East New York, N. Y.
RAILWAY WHEEL.—A. Atwood, Brooklyn, New York, *et al.*
REFRIGERATOR, ETC.—J. H. Wickes, New York city.
SAFETY CHECK, ETC.—J. E. Winner, Philadelphia, Pa.
SASH FASTENER.—N. Thompson (of Brooklyn, N. Y.), London, England.
SHIP ALARM, ETC.—F. X. Wagner *et al.*, New York city.
SMOKING PIPE.—R. S. Manning, Trenton, N. J.
SPARK ARRESTER.—D. R. Proctor, Gloucester, Mass.
SPINDLE CAP.—C. Weller, Philadelphia, Pa.
SPITTOON.—J. C. Moore, Philadelphia, Pa.
TEXTILE FABRIC.—S. Barlow, Lawrence, Mass.
THERMOMETER.—G. W. Schumacher, Portland, Me.
TREATING ORES, ETC.—R. McC. Fryer, New York city.
TREATING PEAT, ETC.—J. N. Rowe (of Rockland, Me.), Liverpool, Eng.
TREATING WOOL, ETC.—J. M. Dick, Buffalo, N. Y.
TUBE CLEANER.—C. B. Rogers, Saybrook, Conn.
UMBRELLA, ETC.—G. B. Kirkham, New York city.
VENEER-CUTTING MACHINE.—H. T. Bartlett *et al.*, New York city.

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Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED DIE FOR MAKING WASHERS.

Jacob Greenwold, Buffalo, N. Y., assignor to himself and William L. Wallace of same place.—This is a die for cutting washers and similar articles at one operation, being intended to be used with a common drop press or punch. The invention consists in making the movable die in two sections that are screwed together, and attaching the central punch by shank and screw nut to the lower section.

IMPROVED WINDLASS WATER ELEVATOR.

Ezra M. Robords, Hutchinson, Kan.—This is an improved apparatus for raising water from wells by wind wheels or other power. It is so constructed that two buckets may be raised and lowered alternately, while the power moves continuously in the same direction.

IMPROVED RUBY PIN INSERTER FOR WATCH MAKERS.

Carl H. E. Bechert, Oroville, Cal.—This is a new form of spring nippers for inserting ruby pins in the rollers of lever watches.

IMPROVED WINDMILL.

William Ford, Great Bend, Kan.—This is a novel contrivance of the wind wheel, whereby the fans are self-adjusting to the wind, and the wheel is kept to the wind without a tail vane. It also consists of a contrivance of apparatus for automatically regulating the speed of the wheel.

IMPROVED ELECTROMAGNETIC CAR BRAKES.

Philip V. Conover, Keatchie, La.—This consists in the employment of an electric helix and a sliding piston in connection with the ordinary car brake mechanism.

IMPROVED FIREMAN'S ELEVATING LADDER.

Berthold Huber, Brooklyn, E. D., N. Y.—This is an improved extension ladder, which may be raised vertically or inclined at any desired angle. It is constructed on the lazy tongs principle, the sides being brought together and the apparatus extended, by said sides being connected to two toothed sections which are turned by hand-crank gearing.

IMPROVED MACHINE FOR MAKING CORES.

William J. Reagan, Pottstown, Pa.—This consists of a revolving stand, to which a number of core boxes of different diameters are hinged, the length of the cores being determined by adjustable pistons carrying the core-supporting vent pins.

IMPROVED SCREW-CUTTING MACHINE.

Charles W. Roberts, Cohoes, N. Y., assignor to Norman W. Frost, of same place.—The object of this invention is to improve the construction of the machine known as the C. W. Roberts pipe-cutting and threading machine and vise, so as to make it more convenient in use and more effective in operation. It embodies a number of useful and novel improvements, mainly in construction, which it is hardly possible to describe without the aid of drawings.

IMPROVED FEED MECHANISM FOR THREAD WINDING.

Ambrose Giraudat, Neuvy (Norwood P. O.), N. J.—This is an ingenious machine for winding threads for making stamens for artificial flowers, and for other uses. It winds the threads regularly and at equal distances apart, or at a greater or less distance as may be desired.

IMPROVED RAILROAD RAIL CHAIR.

John L. Rahmsteck and Charles W. Rahmsteck, Rahway, N. J.—In this device a movable plate is made to fit between the rails and the inner surface of a lock flange, and is provided with toes and wedges, constructed and arranged to operate in connection with each other.

FRICTIONAL GEARING.

Moses Ray, Valley Grove, West Va.—This invention relates to the transmission of power to machinery through smooth-faced friction wheels, and consists in arranging the shaft that drives the machinery in bearings that are held forward with greater or less pressure, according to the character of the work, while it will yield to any undue strain to avoid fracture or injury to any part of the machinery.

IMPROVED METAL-CUTTING MACHINE.

Jacob Schofield and Joseph Stevens, Newton, Ia.—This machine is for shearing off pieces of iron of different thickness, and comprehends two cutting jaws, of which the lower jaw is adjustable to different hights, while the upper jaw is brought down by suitable lever power.

IMPROVED MACHINE FOR MAKING TWIST DRILLS.

Edward S. Taber, New Bedford, Mass.—This is a machine for making twist drills with increasing pitch or inclination of the grooves. It consists of a graduated cam combined with the mandrel which advances the blank along and revolves it to the cutters, which causes the advance of the mandrel to increase in speed as the work progresses, and thus increases the pitch.

IMPROVED MIDDLINGS SEPARATOR.

Joseph P. Reel and Andrew J. Seyler, Cedarville, Ill.—This invention comprises a reel in which the fine middlings are first separated from the light coarse matters to be discharged, and air blast apparatus and sieves for separating the remaining middlings from the residue passing out of the tail of the reel.

IMPROVED HOSE COUPLING.

George W. Price, San Francisco, Cal.—This invention consists of a tapered ring outside of the hose, said ring screwing into one of the parts of the coupling over another tapered ring inside the hose, so as to bind the hose and thus attach it to the coupling. There is also a kind of detachable hinge joint at one side of the coupling, and sliding keys and hoods at the other side, for fastening the two parts of the coupling.

IMPROVED CUT-OFF FOR WATER CONDUCTORS.

William P. Myer, Terre Haute, Ind.—This cut-off is adapted for leaders of buildings. It is easily shifted to direct the water into one or the other of the discharge pipes, and will always indicate in what position the shifting spout may be set.

IMPROVED FEED WATER HEATER.

Samuel N. Hartwell, Wollaston Hights, Mass.—This consists mainly in the combination of a feed water heater with a grease condenser, through which the exhaust steam is passed, the steam then being drawn to the heating chamber, to which the feed water is conducted in a spray through a coiled pipe with perforated end. The air which accumulates in the heating chamber is drawn off by an air pipe leading to a flue.

IMPROVED CAR COUPLING.

Martin V. Remaly and Joseph F. Kinnard, Kittanning, Pa.—This car coupling couples readily without the stepping in of the attendant. It consists of a drawhead having a central bottom rib, with side openings or recesses for the coupling link to swing therein. The coupling link rests, by a central cross piece, on the rib, and couples with a pivoted hook of the drawhead of the adjoining car.

IMPROVED TOOTH-PICK MACHINE.

Leonard Anderson, Painesville, O.—This invention consists of a couple of veneer cutters, one on each of the two opposite sides of the mandrel carrying the rotating block, and a splitting wheel for splitting the veneers into picks. The latter is geared with the mandrel which revolves the block in such a manner that the cutting and the splitting wheel move up to the block in the same measure that it is reduced by the cutters, thus automatically cutting the blocks into picks, without further attention, after the block is put on the mandrel.

IMPROVED STOP WATCH.

Henri A. Lugrin, New York city.—This invention consists, first, of a quarter second hand and its dial, located on the top of the watch movement instead of the face, whereby the hand can be geared with less complication of machinery than when located on the other side; second, of a minute hand located on the same side of the movement and at one side of the center post, so as not to interfere with the quarter second, in combination with a short section of a dial to be used, if necessary, for counting minutes; third, of the adjusting lever, for shifting the quarter second back to the starting point, also arranged for shifting the minute hand back at the same time.

IMPROVED MACHINERY FOR DRESSING LEATHER.

Harrison D. Chemberlin and Justus P. Luther, Berlin, Wis.—This is an improved machine for scouring leather when taken from the vat, and substitutes machine labor for the tedious process of scouring by hand by means of a machine. It is a combination of the stones and brushes applied to pivoted arms of a revolving shaft. Guide rings or weights hold the stones and brushes to their work.

IMPROVED HAIR-HEADING MACHINE.

Ella J. Crosby, Sabula, Iowa.—This is a rubber-covered base piece, in connection with an adjustable assorting piece, that swings above the base piece and heads the hair by friction therewith.

IMPROVED WINDMILL REGULATOR.

Solomon Vermilya, Plain View, Minn.—This is an improved regulator for windmills, and consists of a friction pulley operated by a fulcrumed and weighted lever in connection with a governor, the pulley operating a windlass that throws the wheel in and out of the wind.

IMPROVED LIFTING JACK.

John B. Fayette and Lorenzo Meeker, Oswego, N. Y.—This improves the construction of the lifting jack, for which letters patent were granted to same inventors, July 13, 1875, so as to give it a greater range and a greater accuracy of adjustment. When a movable tube standard has been adjusted at the proper hight, it is locked in place by turning an eccentric. This construction enables the jack to be accurately adjusted to any desired hight.

IMPROVED EARTH AUGER.

Oscar Rust, Macon, Mo.—This improvement relates, first, to the form of cross section of the body of the auger, whereby the draft or force required to operate it is reduced; and, secondly, to the construction of the head of the auger, and parts connected therewith, whereby it is adapted to slide up and down on the boring shaft, so that it may be removed from the well or hole without raising the shaft, and whereby also certain other advantages are attained in practical operation of the auger. It is an improvement on letters patent granted on August 3, 1875, to the same inventor.

NEW TEXTILE MACHINERY.

IMPROVED FULLING MILL.

Joel M. Baldwin, Evans' Mills, N. Y.—This improvement in fulling mills consists, essentially, of a shaft running through a middle opening in the hammer heads, and working them by an eccentric in said opening. By this, space is economized, the mill can run faster, and the contrivance can be located above the floor. The improvement also consists of a construction of the box and frame in part of metal, making a more permanent mill.

IMPROVE WARP TENSION REGULATOR.

Alexander M. Fyfe, Cornwall, Canada.—This is an improvement in the class of warp tension regulators in which the roll, over which the warp passes from the warp beam, is arranged to be shifted in position, corresponding to the beat of the lathe, by means of levers connected with the latter. By the arrangement the roll will move toward the harness when the lathe swings back after beating up, and at the same time the shed opens; and when the shed closes the roll will move back again as the beat-up takes place, thus relieving the warp of undue strain by the shed, and at the same time making uniform tension.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BARBED FENCE WIRE AND BARB FORMER.

William H. Jayne and James H. Hill, Boone, Iowa.—The first is an improved four-pointed fence barb, composed of two pieces of wire bent into the form of a U, from opposite sides of the fence wire, in such a way that the bend of each piece may be between the arms of the other. The arms are bent down upon and around the said fence wire, leaving the four points projecting in opposite directions. The same inventors have also devised and improved a fence barb former, which is an improvement on a similar device for which letters patent were granted to them January 18, 1876. The invention consists in an improved barb, four slotted disks, and the three handles, connected together and operating so as suitably bend the wire.

IMPROVED WIRE FENCE TIGHTENER.

William F. Daniels, Lime Spring, Iowa.—In using the device a bar is hooked upon the wire, and a cylinder is put in in such a way that the wire to be tightened may pass into its slot between the arms of the bar. The cylinder is then turned, winding the wire around it, until the said wire has been drawn to the desired tension, where it is held by a pawl and ratchet wheel.

IMPROVED TOY BOX.

Joseph Kayser, New York city.—This is a box for candies, collars, and other purposes, which produces, by the opening and closing of the drawer, a change of pictures on the top part of the box.

IMPROVED GLAZED PLAID PAPER.

John F. Marsh, Springfield, Mass, assignor to Springfield Glazed Paper Company, of same place.—This is a new method of manufacturing glazed plaid paper, consisting of the following steps consecutively performed, namely, coating the paper with an ordinary glazing preparation, ruling the glazed surfaces in suitable colors and designs, and finishing or glazing the coated and ruled surface by polishing or pressing the same.

IMPROVED COFFEE SHELLER.

José A. Mosquera, Caracas, Venezuela.—This is a machine for shelling coffee in a rapid manner, so that the beans are freed from the shells or pods without being crushed or broken. It consists of a grooved and notched revolving cylinder that breaks the shells in connection with suitable knives. The lower separating knife is placed nearer to the cylinder than the upper breaking knife.

IMPROVED BAYONET.

Samuel W. Hill, Pittsburgh, Pa.—This is a ramrod and bayonet combined in one device, and so constructed that it serves for both purposes equally as well as the ordinary ramrod and bayonet do for their respective purposes.

IMPROVED MIRROR.

Henry Goldberg, Herkimer, N. Y.—This is a reflecting mirror, suspended from the ceiling by means of straps attached to the sides of the frame, passing over pulleys on the ceiling and attached to a single adjusting strap. It can be conveniently manipulated by a person standing between the ordinary mirror and the suspended reflecting mirror.

IMPROVED REVOLVING SCRAPER.

Edward Huber, Marion, O.—This invention consists in inwardly curved upward extensions formed upon the rear ends of the sides of the scraper, and in an apron attached to the cross bar of the handles to overlap the back. The extensions rest upon the earth when the scraper is tipped over, to prevent the earth from being scraped up by the back. The apron prevents the earth from slipping over said back.

IMPROVED CAKE CUTTER.

James Collins, Central City, Col. Ter.—This consists of a cutter with a central sliding and spring-acting part for forming and cutting, simultaneously with the outer part, the article to be produced.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VENTILATING CAR.

Edward C. Ibbotson, Chelsea, Mass.—Diaphragms of wire are placed beneath the portion of the roof which extends over the platform. Above the diaphragms are chambers which communicate with the interior of the car, and also with cowls on the roof. The air enters under the diaphragms and escapes by the cowls.

IMPROVED GATE.

Emerson Lyon, Stoughton, Mass.—This gate is suspended on rollers, attached to hangers from an upper cross bar. For the passage of wide or high loads the gate is pushed back, so that it and the bar are balanced upon a post, and the gate and bar are then swung around upon the pivot of the post into a position parallel with the roadway.

NEW HOUSEHOLD ARTICLES.

IMPROVED DISH CLEANER.

Robert W. Chappell and Isaac Mayfield, Spencer, Ind.—This invention consists in connecting a chamber for holding the dishes or other articles with the upper part of a pump cylinder by a pipe, and with the water tank by a spout; also, in using a gate and rack in connection with the dish chamber.

IMPROVED STEAM COOKING APPARATUS.

Stillman Wilkins and James D. Murphy, Abingdon, Ill.—This consists of a series of traps, through which pass concentric tubes. When the cooking is to be wet the bottom of the section is made flat, and the part of the tube above said bottom is close, or made without perforations. When the cooking is to be dry, the bottom of the section is concaved, and the part of the tube above said bottom is perforated, so that the water of condensation may flow down through the said tube. Any desired number of sections or trays may be used, and the upper section or tray is provided with a conical cover, which brings the steam to the center.

IMPROVED STOVE PIPE THIMBLE.

Charles Inward, Riceville, Iowa.—This is an improved thimble for connecting a stove pipe with a chimney, or with a wall or ceiling through which it passes. It is formed of an inner part, provided with the collars, and an outer part, made in halves. One half is made in one piece with the inner part, and the other part is hinged at one edge to the edge of the first half, and secured at its other edge by a hand screw and lugs.

IMPROVED CLOTHES WRINGER.

Samuel F. Leach, Chelsea, Mass.—This is an improvement in the clothes wringers formed of two elastic rolls arranged to work in frictional contact and rotate in opposite directions. The object is to reduce the friction incident to the use of such wringers in consequence of the pressure of the springs. To this end a pair of spiral springs is applied at each end of the rolls, and they are connected at their upper ends with a cross bar carrying small friction rolls, which are mounted in a small frame and bear on the journal of the upper roll. The journals of the lower roll are supported on similar friction rolls.

IMPROVED STEP LADDER.

John Calvin Blauvelt, Blauveltville, N. Y.—This mainly relates to an improved construction, whereby a step ladder may be readily adjusted for use as a ladder, without it being necessary to turn it away from the wall or other object.

IMPROVED METHOD OF MAKING TEA AND COFFEE.

Jonathan Miller, Himrod's, N. Y.—This invention relates to a new method of preparing decoctions or infusions of tea, coffee, etc., and it consists in the method of filling a tight and unyielding chamber full of the ground coffee or tea, and then passing the hot water through the same, whereby the expansion of the grains consequent upon the absorption of the water produces a considerable pressure, which, in the unyielding chamber, fills up the little interstices or channels between the grains, thereby preventing the fine dust or pulverized portions of the coffee from being washed through and compelling the water to permeate the pores of the coffee grains in its passage through: the said expansion in the filled chamber acting in the nature of a press, so that the bulk of the coffee is held as in a solid mass below the supernatant water.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FRUIT PICKERS' BASKET.

Orville W. Odell, Woodhull, N. Y.—This is a bucket so constructed that the picker can lower it and empty the fruit without coming down from the tree and without injuring the fruit. The novel features consist in arrangements for allowing the bottom to open and the fruit to escape.

IMPROVED CULTIVATOR.

Casper Oehrlein, St. Paul, Minn.—This invention may be adapted as a furrow opener, to make furrows for the reception of the seed, and rakes may be attached to it for cultivating potatoes, by loosening the soil and tearing up weeds.

IMPROVED CHECK ROW PLANTER.

Joseph Rothchild, Shelbyville, Ky.—In this machine are embodied new and ingenious devices for dropping the seed at a greater or less distance apart, the adjustments of which are effected by a simple lever motion.

IMPROVED WHIFFLETREE ATTACHMENT FOR PLOWS.

Thomas B. Baldwin, Troy, Pa.—This consists of the roller commonly connected to the plow beam, for gaging the depth of the furrow. It also holds up the whiffletrees and the traces, and prevents the horses from stepping out of the traces.

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Notes & Queries

W. P. will find something on the use of petroleum in boilers on p. 164, vol. 30. As to zinc in boilers, see p. 315, vol. 34. Engineers of pleasure steamobats must be duly licensed. See p. 228, vol. 32.—C. H. B. will find a table of the values of metals on p. 169, vol. 32. We publish an index in each volume.—C. S. R. will find directions for galvanizing cast iron on p. 346, vol. 31.—W. H. D. will find directions for making friction matches on p. 75, vol. 29.—D. J. will find a recipe for paint for outdoor work on p. 409, vol. 31. Celluloid is described on p. 23, vol. 33.—J. McG. will find a recipe for waterproof glue on p. 42, vol. 32.—H. D. E. will find directions for separating alumina from clay on p. 91, vol. 32.—J. I. W. is informed that we cannot recommend a boiler scale preventive unless we know what impurities the water contains.—M. M. H. is informed that his query as to the wagon wheel is answered on p. 293, vol. 31.—J. T. R. should consult a physician.—W. J. will find an answer to his query as to pitches of gas pipe threads on p. 378, vol. 32.—C. L. R. will find a recipe for rubber cement on p. 203, vol. 30.—W. M. will find a treatise on taxidermy on p. 159, vol. 32.—A.B.R. will find a description of the process of refining petroleum on p. 340, vol. 26.—J. J. R. will find directions for bronzing castings, on pp. 11, 85, vol. 33.—J. B. K. will find directions for annealing gold on p. 299, vol. 28. D. C. W. can cement rubber to cloth with the compound described on p. 203, vol. 30.—J. J. H. should address a manufacturer of air compressors.—L.M. will find directions for straightening wire on p. 299, vol. 34.—G. W. E. will find directions for making Vienna yeast on p. 185, vol. 33.—W. N. S. will find directions for making marine glue on p. 42, vol. 32.—A. L. L. will find directions for making rubber stamps on p. 156, vol. 31.—F. R. B. should address the manufacturers of the rifle in question.—E. T. C. will find directions for fireproofing shingles on p. 280, vol. 28.—F. M. H., A. L. H., E. P. B., H. A. T., J. A. B., J. B. K., A. B. R., W. M., W. P. M., B. O., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. S. B. says: I have a room divided by a partition wall, over which is a space of 2 feet; and I wish to know how mirrors may be placed so that a person in one room can see a particular point in the other? A. Place a mirror over the partition in such a position that it will reflect the light coming from the desired point in one room to the observer in the other.

(2) A. McC. says: 1. There is an engine in this vicinity 18x 24 inches; it runs at 90 revolutions a minute with 60 lbs. steam, and cuts off at ⅝ stroke. It is estimated to supply about 50 horse power. It takes steam from two boilers, each 4 feet in diameter by 14 feet long, each containing 56 three inch tubes. The grates are 4½x8½ feet, and are set 22 inches from boilers. The bridge wall is 6 inches from boilers, and there is a good draft. This engine requires on an average 1½ tuns of Illinois coal per day of 10 hours. The company are greatly dissatisfied at the amount of coal burnt, and wish to find some way to reduce it. Is the amount unreasonable? A. Under the conditions stated, the engine is not working as economically as could be desired. 2. Can you suggest any improvement in the setting of boilers? A. Before making any change it would be best to find out the cause of the excessive consumption, whether it is due to defects of the engine or inefficiency of the boiler, and this could only be determined by experiment.

(3) W. J. McG. asks: 1. When was the planet Uranus in perihelion? A. Uranus will be in perihelion in January, 1883. 2. Were Mars and Jupiter in aphelion during October, 1874? A. Yes, Jupiter on the 24th, Mars on the 25th. 3. What angle will the equator have to the ecliptic at the middle of the next Platonic year? A. A Platonic year is a period of time determined by the revolution of the equinoxes. This revolution, which is calculated by the precession of the equinoxes, is accomplished in about 25,000 of our years. Assuming that the Mosaic record of creation is correct, this world is now near the end of the first quarter of the first Platonic year, and astronomy has not informed us exactly in what position the earth will be in 30,000 years hence; but from the latest observations, the angle will be between two and three degrees less than at the present time.

(4) H. B. asks: How can I calculate at what rate of interest, compounded yearly, $2,000 is of the present value of 120 monthly payments of $40 each, first payment due at the end of one month? A. We believe it would be necessary to solve this by interpolation, calculating present values for different rates of interest. Some of our readers may be interested in making the solution.

(5) J. D. R. says: A brother and myself are about building a small steamboat, but differ in regard to the kind of engines. We want to use 2 engines 10 inches in diameter, to drive a main shaft at 20 to 25 revolutions per minute. My brother contends that 10x12 engines, geared so as to make 4 revolutions to one of the shaft, would be best, while I contend that 2 engines 10x48 inches, attached directly to the main shaft, would be less liable to break and use no more steam. Which would you recommend? A. We think your plan is preferable.

(6) M. C., Jr. says: I am using 2 engines (on the same shaft, working at right angles to each other) 8¼ inches in diameter and 30 inches stroke, making 30 revolutions per minute, with an indicated boiler pressure of 85 lbs. to the square inch. How many feet of 2 inch gas pipe (entirely surrounded by cold water) will it take to condense the exhaust steam from those engines, and leave the water so condensed at a temperature of 170° Fah.? Can I attach the end of the 2 inch pipe to my feed pump directly, in place of the air pump, and so force the water back into the boiler as fast as it is condensed? A. We do not think you can make this arrangement work very satisfactorily.

(7) S. F. H. asks: 1. What would be proper dimensions for a steam yacht about 20 feet in length? A. Make it of 5 feet beam and 2 feet draft. 2. What would be the proportions of an engine, boiler, and screw, and the pitch of screw necessary to drive the boat at a speed of 5 to 10 miles an hour? A. Use a propeller 2 feet in diameter and of 3 feet pitch, and an engine 3 by 5 inches. Boiler should be 28 inches in diameter, 3½ feet high.

(8) Y. E. says: 1. We have twin tubular boilers, the tubes of which have been in about 4 years, and are now giving out. We have had 3 new ones put in since last summer, all in the lower row. They all crack where they are expanded, just behind the front boiler head. As I think 4 or 5 years too short a time to last, I want to know if you can assign any cause for their failure. We use tannate of soda, and the tubes are not badly scaled. We use common tallow in cylinder, and heat the feed water with exhaust steam. A. It is not uncommon for tubes to give out in this time, even with careful management; and as in other cases they last much longer, the result is commonly attributed to defective material. 2. When we blow some water out of the boilers (which we do once or twice a day) and open the blow-off cock wide, there is a heavy jarring in the boilers, the check valve rattles, etc. I think this is caused by the connecting pipes between boilers and mud drum being too small. Can said jarring injure the tubes? A. The jarring you speak of certainly does no good, and we think it would be worth your while to have it stopped. 3. How was Mr. L. Cooper's boiler of 1 inch gas pipe (described in No. 13 of your current volume) built? A. Mr. Cooper will perhaps oblige this and several other correspondents by replying. 4. Are self-packing or steam-packed rings in cylinders generally considered better than common cast iron rings tightened with springs? A. There is considerable difference of opinion on this subject. 5. Will a glass water gage, placed about 6 feet from boiler and connected thereto by half inch pipe with two elbows, show the hight of water correctly, or should the pipes be larger, or the gages be nearer the boiler? A. It would be better to use larger pipes.

(9) W. E. D. says: 1. I have a second hand upright iron boiler, 12 inches in diameter and 4 feet long: when new, it was tested to 130 lbs. pressure. Would it be safe to put in 12 one inch gas pipe flues, and use it for running an engine? A. We think it would answer with a single flue through the center. 2. Which way would be the best to set it, upright or horizontal? A. Set it upright. It would be well to test it before use.

(10) E. A. McC. says: 1. I have for several years used large quantities of peaty muck for bedding stock, and as an absorbent of the liquid manure and the gases from manure while fermenting. The bedding and green muck forms from a half to two thirds of my compost, which I consider very valuable after heating for several weeks and turning once or twice. I have now a pile of peat muck which was put in wet last fall, with two wheelbarrow loads of green horse manure at the bottom to start the heating. A few days since, with thermometer at 40° outside, the pile showed, at 18 inches below the surface, a temperature of 126°. Professor Kedzie, of the Michigan Agricultural College, says that this brown peat muck, so abundant in our Michigan swamps, is worthless. Is this a fact? A. Professor Kedzie's opinion is very probably correct. 2. Does heating benefit or injure it? A. It is to some extent beneficial. 3. Can sulphuric acid be used, on green peat, as a heating agent? A. No.

(11) L. H. E. asks: Having the area of an ellipse, how can we find the two diameters? A. You must assume one.

(12) C. D. P. F. says: In a country place we use water from the river, and it is not clear. We pump by steam through some 1,000 feet of pipe to a cistern about 130 feet above the river level. By the peculiar formation of the river bank, we had to place the steam pump some 20 feet above the river, and the question is what kind of filter we should use, and where it should be placed. We had a small box filled with sand placed in the cistern, and the pipe leading to the house, but it was so small it would not answer. In addition, the iron pipe stains the water; and having been affected by water taken through a galvanized pipe from the well, we are prejudiced against this form and also lead pipes. How can we clean the iron pipe to prevent the discoloration? A. As to filtering the water, see p. 267, vol. 34. We presume the iron rust shows itself in the water only when the pump is first started, and the water afterwards runs clear. If this is so, you should arrange your pipe with faucets to admit of discharging this discolored water outside of your cistern, and also to exhaust your pipe when not in use, that the waret may not then stand in it.

(13) J. O. asks: 1. What is the best material to use in the division wall of a double house? I have tried a brick one, but one can easily hear in the next house. A. Where you have tried brick your wall was probably only 8 inches thick, and the floor joints meeting at the center of the wall, they left, in shrinking, open crevices through it. If you make the wall 12 inches thick, and place 4 inches of brick between the ends of the floor joists, your wall will be tight enough.

(14) J. B. T. says: We have been heating a new church, 40x60 feet, with a single hot air furnace in the basement, placed in the center, about 20 feet from the front, with one large register in middle aisle, directly over furnace. The church is only one story high, and the excavation in the cellar, where the furnace is placed, runs across the whole width of church and extends back to the furnace. There are two open windows about 2 feet square inside walls of cellar, about 4 feet from front. One of these has a trough about 1 x 2 feet, running in horizontally, about 12 feet parallel with front wall, for cold air. There is no ventilation in ceiling. Our trouble is that in very cold weather we cannot get the thermometer (placed about 4 feet above floor) higher than 58° or 60° Fah., yet with this amount of heat below, the air in the gallery that runs across front of church, about 12 feet high, is so hot as to be almost unendurable. Can you tell me what will remedy this? A. Try a ventilating register under each window, communicating indirectly with the exterior air; this will enable the heated air in the upper part of the church to expand, and drive out the cold vitiated air at the bottom.

(15) O. O. J. asks: 1. Can the stroke of a common slide valve of an engine be lengthened by the eccentric? A. Yes, by employing an eccentric having more throw. 2. Which is the most economical in fuel, to set the valve at a quarter of an inch lead, cutting off at one half stroke, or at one sixteenth lead, cutting off at three fourths stroke, engine running at 80 revolutions a minute? A. Cutting off at the half stroke would be the most economical. Your condition of lead should be just reversed, however, since, the longer the steam follows, the greater the necessity for lead. 3. Is common black oil good to put in a boiler to keep it from scaling? A. Some people recommend it, but the value of an anti-incrustator depends on the quality of the water used.

(16) A. B. C. asks: Will I lose power by belting a saw and grist mill so that the belt will run from bottom of driver toward driven pulley, and returning on top? A. It is better to run the belt the other way; but the difference, if the belt is given ample width for its duty, will not be practically appreciated unless the belt is very long, or of very common leather.

(17) J. J. asks: 1. Is it possible to caseharden cast iron? A. Yes. 2. Could car axle journals be hardened by the application of any substance while in motion, so as to become harder by friction? A. Not more than they would be by the casehardening which ordinarily takes place on a surface subject to friction under a pressure. 3. Is chilled cast iron or casehardened iron the hardest? A. There is a very little difference in favor of chilled cast iron.

(18) O. D. asks: Why are rubber gaskets injurious to boiler plate? I have several manhole plates in my boiler, and the edges of the sheet iron corrode away quite rapidly. What action, if any, does the rubber have on iron? A. Possibly the sulphur induces a chemical corrosive action.

(19) J. D. J. asks: 1. Can the lap on a slide valve be increased or diminished so as to make it cut-off at any point desired, by setting the eccentric so as to give the valve more or less lead? A. No. 2. You say that a person who wants to run a stationary or portable engine in New York city must furnish a certificate of competency to run an engine. Where can he get the certificate? A. Inquire at the police station of the district.

(20) G. S. N. says: My engine is 2x6 inches with a fly wheel 15x2¼, making 200 revolutions per minute. I wish to drive a lathe whose changes of speed on cone pulley are 6, 5⅜, 4¼, and 3¼ inches. What sized pulley must I have on drive shaft to give the lathe the proper speed? A. Use one 10 inches in diameter.

(21) P. F. says: If the packing rings in a cylinder were subjected in their travel at one point to a steam pressure of 275 lbs. to the square inch, and at another point in their travel to 75 lbs., what would be the result in one year's use on a locomotive running 100 miles a day? A. The packing used under the greatest pressure would wear the most.

(22) G. B. asks: Will glycerin have any poisonous effect on the system, if used to preserve meat, fish, etc.? A. No. Glycerin is not injurious.

(23) E. W. asks: 1. In what part of the earth's revolution around the sun is our planet at the average distance from the sun stated by astronomers? A. The distance stated by the books is a mean between the shortest and longest distance. 2. How much does the orbit vary in distances from the sun? A. The difference is about 3,000,000 miles.

(24) Sprague & Co., Glenwood, Iowa, say: In your issue of April 15, you tell R. S. Jr. that his engine, of 2¾ inches bore and 5½ inches stroke, is rather too small to drive the engine lathe of 16 inch swing. We have an engine (our own make), of 2¾ inches bore and 4 inches stroke, that drives a 20 inch swing engine lathe, 6 foot iron planer, drill press, shop grindstone, and milling barrel for foundery, and about 40 feet of main line shaft all at once, with 80 lbs. steam in boiler. It makes 220 revolutions per minute, and cuts off at ⅞ of the stroke.

(25) H. P. B. says: 1. We have two boilers, one upstairs and one down. Can they be connected so that we can draw from the lower when there is not enough hot water in the upper, for a bath room? A. Yes.

1. Of what are eggshells composed? A. Mostly carbonate of lime. 2. Can they be made use of? A. They are used in medicine.

(26) H. A. J. says: We mine clay by sinking large pits, 50 feet in diameter at the surface, hoisting the clay out by means of a derrick and hoisting engine. These pits are often sunk to a depth of 50 or 60 feet, and our trouble lies in getting out the water. We are now hoisting it out with a large hogshead, having seen nothing that we thought was more easily worked. It is impossible to let a steam pump down, as the sides are slanting, and, if broken, would cave in. Can you tell me of any pump, worked by hand or steam power, that would overcome the difficulty? A. From your description we think you could put in what is known as a submerged pump, to be worked by levers wherever desired, or a steam siphon or vacuum pump.

(27) W. W. S. asks: 1. How is carbon, such as forms in gas retorts, worked into regular shape? A. By sawing. 2. Which is the most powerful electric battery? A. Grove's battery is one of the most powerful. The negative element consists of a thin strip of platinum placed in a porous cell

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containing nitric acid. An amalgamated zinc casting, contained in an outer cell nearly filled with water, serves as the positive element. The water is acidulated with from 10 to 12 parts by weight of sulphuric acid.

(28) S. H. K. asks: Can the Gramme magneto-electric machine be constructed of hand power capacity, and its light practically adapted to magic lantern illumination? A. We think not, unless it might be in conjunction with one of Gassiot's carbonic acid vacuum tubes.

(29) G. H. E. says: 1. I have made a telegraph instrument. I put on the magnet 1,050 feet of No. 32 wire, covered with cotton, but it does not work. I am sure the wire is on right. I intend it for a relay, but when attached to a battery it does not show the least attraction. How many feet and what size of wire should I use for the instrument to be worked with a hundred miles of wire? A. You need three or four times as much wire to get good results.

(30) M. A. W. says: I have made a battery with inc zand carbon plates. I ground coke and mixed with it molasses and baked it, for the carbon, and used old scrap zinc amalgamated for the other plates. Each is fastened to a strip of pinewood, screw cups rising above for connection. Both are suspended in a porcelain cup, containing a solution of bichromate of potash, sulphuric acid, and water. The zinc is acted upon very perceptibly; but on bringing the wires together, there is no current, nor the least sign of a spark. I have seen a battery, to all appearances the same as mine, that was a powerful one. What is the trouble with mine? A. A battery of that description gives little or no spark. If the connections are properly made, it should work a small telegraph sounder very well.

(31) F. H. M. says: 1. I have a wooden house standing about 600 feet from the sea. In rear of the house, about 15 feet away, is a large rock, and another stands about 10 feet in front. Do you advise me to put a lightning rod on my house? A. A good rod, properly attached and having a good earth connection, will certainly offer great security to the house. 2. Is any danger from lightning incurred by using the wires of a district telegraph company? A. Theoretically, yes; but we have never known harm to result from this cause.

(32) B. D. asks: Is it necessary, in order to secure the safety of a building against lightning, to have two ground connections? A. If it were possible to have one ground connection with no appreciable resistance, that would be sufficient. It is better, however, not to depend upon one ground unless you are sure that it is a good one. Earth connections, as generally made by lightning rod men, are, 9 times in 10, worse than useless.

(33) J. M. says. 1. Please inform me if, in making an induction coil, the primary and secondary coils are connected in any way, or only wound upon each other, with insulator between? A. They are not; keep them well insulated from each other. 2. Is the battery connected with the two ends of the primary, and the shock received from the two ends of the secondary? A. Yes. 3. What size of iron wire shall I use for the bunch in the core? The magnet is 6 inches long x 1½ inches diameter. A. No. 18 or 20. 4. Will 6 (No. 1) cells of Leclanché's battery be enough? A. Yes, but the circuit should only be closed for a few moments at a time if the Leclanché battery is used.

(34) F. E. says: 1. I am making an induction coil and battery. The coil is 8 inches long and intended to be about 6 inches thick. Primary wire is 1½ inches in diameter, and secondary $\frac{1}{80}$ inch, the sizes you gave in answer to a former questioner. Primary wire is 100 feet long, and secondary 1,200 feet. Primary is covered with cotton, secondary with silk. Both are covered with thin narrow strips of cotton and silk respectively, lapping about ⅛ to ¼ inch, kept tight with a little sealing wax here and there. The battery is a ½ gallon one cell Grove. Are these proportions right, and is the machine strong enough to give good shocks? The coil is ⅝ inch in diameter, and is composed of 80 iron wires. A. You will not get much spark without greatly increasing the length of the secondary, but such a coil will give severe shocks. 2. How can I make the simplest current breaker? A. A spur wheel with spring contact is one of the simplest. One side of the circuit is connected to the wheel, the other to the spring. By turning the wheel, the current is interrupted as the spring falls from one tooth to another. 3. Will a 1 inch wide piece of thin platinum foil be the correct size for the above battery? A. Yes. 4. Can I make the porous cup of plaster of Paris, very thin, so as to be quite as good as earthenware? A. Plaster cups do not answer. Use clay cups.

(35) A. S. says: Please inform me if a way has been invented to telegraph a person's own handwriting. A. Yes, several. Caselli's pantelegraph has been used for commercial business in France. By this system, pictures as well as writing can be transmitted.

(36) E. M. R. asks: 1. How can I strengthen a steel magnet that has lost its power? A. By passing each half several times in the same direction over the opposite poles of a strongly charged electromagnet. 2. Why will not a register work on a long circuit? A. Because the current is too much weakened by the resistance of the line. Register magnets are ordinarily wound for circuits of low resistance. By rewinding with small wire, and greatly increasing the number of convolutions, they can be made to work very well on long circuits.

(37) C. H. F. says: I have a new constant current 20 cell battery. Can I apply any attachment that will give an interrupted current for medical use? A. A small magnet placed in circuit, and connections so made that the latter is broken every time the magnet attracts its armature, might answer.

(38) M. L. L. says: I have observed some points in experimenting with an ordinary line relay of forty ohms on a line four miles long, having five other relays of the same resistance in circuit, which seem very peculiar; and I shall be glad if you can assist me to an explanation of them. I prepared a dark box, as used by Edison in experimenting with the "etheric" force, but instead of the common pencils I used two lumbermen's pencils, with points cut square across, which were ¼ inch wide and $\frac{1}{16}$ thick. I connected a wire from one of the pencils to one of the main line connecting posts of the relay, and one from the other pencil to the armature; and upon opening the key I noticed through a ¾ inch hole in the box, a white spot of light (not a spark) the size of a silver three cent piece, which was only visible upon opening circuit; and after opening circuit two or three times the spot would disappear entirely, and it would require fine adjustment of the pencil points to get the light again. I again tried the experiment with another pencil, the points of which were ⅛ inch square, and I only got the center part or strip of the spot, about ¼ inch wide. I can get similar results by connecting the wire to the core bar of the relay instead of the line post. A. Unless the spot was due directly to the battery current, as it most likely was, you have been deceived by reflection or irradiation. Further experiment will make this evident.

(39) G. D. P. asks: What chemicals are used in automatic telegraphy to prepare the paper for receiving dispatches? A. The best solution for this purpose is the following: Water 100 parts, nitrate of ammonia 150, yellow ferrocyanide of potassium 5.

(40) C. A. says: 1. Please give a description of the Siemens and Halske galvanic cell. A. Siemens and Halske's battery is a modification of the sulphate of copper cell. It consists of a glass jar in which a copper disk is placed. Over this is a bell-shaped tube of unglazed porcelain through which vitriol is dropped as required. The jar is about half filled with paper pulp, and on this is put an annular disk of brown paper or cotton cloth. The zinc rests on the paper in a solution of zinc sulphate. 2. What are its internal resistance and electromotive force? A. The electromotive force is the same as the Daniell's cell, but the resistance is considerably higher, though not so high as to prevent the use of the element for local.

(41) A. F. B. says: What is the best form and size to make an electromagnet, not over 3 inches long, to develope the greatest attractive or lifting power with all the battery needed for the purpose? With what size of insulated wire should the cores be wound, and about how much should be put in a coil? A. Make a soft iron horseshoe magnet. Use No. 14 copper wire, 160 feet in a coil.

(42) A. B. says: 1. I wish to make a magnet with a core 2½ inches long, made of soft iron. What should be the diameter of the core? A. This depends upon the battery used. 2. What size of cotton-covered copper wire should I use? A. Use 240 feet of No. 16 copper wire, and two or three cells of Daniell battery will be found effective.

(43) B. L. asks: 1. In working a foot lathe, shall I be able to use a lighter fly wheel by fixing a spring to assist the return motion? A. Yes. 2. Shall I lose any power by applying said spring? A. Yes, a little.

(44) W. L. asks: Can you give me a recipe for a soldering liquid that will mix with oil? A. We do not know of any such preparation.

(45) H. and H. ask: Can you give us a recipe for bleaching chair cane? A. Have you tried sulphurous acid or chlorinated lime? If the cane be freed from grease by a little solution of carbonate of soda, there should be no difficulty.

(46) A. W. asks: Is there any way of taking the stain out of red or stained cotton without injury to the staple? A. Send us a piece of the goods in question, plainly marked with your name and address.

(47) J. H. H. asks: Is there a liquid, solution, compound, or any substance that is adhesive to tin and insoluble in linseed oil? A. Melt together in an iron pot equal parts of pitch and gutta percha. Use while hot.

(48) J. C. R. asks: How can kerosene stains be removed from marble? A. Cover the stain with hot pipe clay and allow to cool gradually. Repeat the operation if necessary.

(49) A. S. asks: How can I keep oil paint, used on flags, soft, so that the paint will not break when perfectly dry? A. Try the following: Dissolve 2½ lbs. good yellow soap in 1½ gallons boiling water, and grind the solution while hot with 1¼ cwt. good oil paint.

(50) W. R. H. asks: 1. What is there in refined kerosene oil that causes it to cut rubber tubing? A. Kerosene oil partially dissolves rubber. 2. Can any substance be added to the oil to counteract the effect? A. There is nothing that can be added to the oil that will prevent this action.

(51) M. F. G. asks: Please give me a recipe for making black ink, with a rich gloss. A. A fine gloss may be given to any good black ink by the addition of a suitable quantity of sugar. For the preparation of inks, see numerous recipes in back numbers.

(52) E. H. asks: What is the proportion of the compound salts used for the bichromate batteries? A. In 1 gallon of water dissolve 10 ozs. bichromate of potassa; to this add 1 pint of strong oil of vitriol. When cool, it is ready for use.

(53) R. M. A. asks: Can you give me a simple and effectual solvent for paint? A. Rub quickly over the surface a strong solution of potassa in alcohol, and rinse immediately in water to remove traces of alkali.

(54) W. H. A. asks: What can you recommend for an oven lamp in place of gas, which we are now using in three rotary ovens, which require light inside? A. In a somewhat similar case, we have known a good variety of coal oil to give satisfaction.

(55) N. A. W. says: I have been trying to hermetically seal tin cans containing cold fruit, after exhausting the air with an air pump; but the air rushes back into the can. How can I successfully and perfectly perform the operation? A. Solder a tube made of some easily fusible alloy into a suitable opening made in the can. Then fill the vessel with the fruit, and seal every other opening except the tube; place the open end of the tube in connection with the vacuum chamber of the air pump, remove as much as possible of the air, and, by the application of a hot flame or iron, close the tube close to its junction with the can.

What is caustic ammonia? A. Spirits of ammonia (*spiritus ammoniæ causticæ*) is prepared by passing gaseous ammonia into rectified spirit (alcohol) which absorbs it. Caustic ammonia, liquor of ammonia, or aqua ammonia is a strong solution of the gas in water.

(56) J. D. McC. asks: Is there any chemical process by which the disagreeable smell can be taken from coal oil without destroying the virtue of the oil? A. Agitate for some time with strong oil of vitriol, wash with clean water, and finally agitate with lime water, and allow to settle.

(57) J. E. P. says: One of your correspondents was good enough to advise me to use gum tragacanth with white pigments, and to spray with caoutchouc dissolved in naphtha. I find the latter makes a dirty solution, and I have no guide as to proportions. How is this solution prepared? A. In order to facilitate the solution of the caoutchouc it is better to use a large excess of the gum. Allow solution to go on for about 12 hours; strain through a linen cloth, dilute largely with fresh naphtha, and filter through clean filter paper. If the solution is too dilute, allow it to evaporate until of the required strength, which experiment will best teach you. We do not think this preparation is a commercial article.

How are the figures of ferns and other flowers produced on fine muslin? I have heard that the spray or atomizer is used for this purpose. Can you give me the process? A. Use an atomizer containing a solution of one of the aniline colors.

(58) C. H. K. asks: I send you some samples of waterproof material which will do for covering furniture, but are not waterproof enough for outdoor work. I use glycerin in the manufacture; but when I put water on the articles it draws the glycerin out, and, when dry again, the surface cracks. Can you tell me any way of avoiding this? A. Try dipping for a moment in a clear but weak solution of caoutchouc, and allow the solvent to evaporate in the air. By this means a delicate transparent film of the india rubber will remain, adhering strongly to the cloth.

(59) A. G. N. asks: 1. Would galvanized iron rope be suitable for a lightning conductor? A. Yes. One about half an inch in diameter is preferable to smaller sizes. 2. How should the point be joined to the wire, and of what material should the point be composed? A. Points can be made of any metal; galvanized iron points answer very well, and may be fastened by soldering.

(60) W. B. C. says: My cistern water has suddenly become very hard. How can I soften it? A. Try the addition of a little lime water. This will decompose the bicarbonate of lime held in solution, and fall with it to the bottom as an insoluble powder. Allow to settle for a short time before using it. Experience will teach you the proper proportion of the lime solution to add.

(61) J. F. asks: What is resorcin, and how is it made? A. Resorcin ($C_6H_6O_2$) is a compound isomeric with pyrocatechu and hydroquinone, and homologous with orcin. It is obtained by the action of melting potassa upon galbanum, a gum resin imported from Africa. To prepare it, the resin, freed by alcohol from its gummy constituents, is fused with 2½ to 3 parts hydrate of potassium till the mass becomes homogeneous. Water is then added, the liquid acidulated with sulphuric acid, and filtered when cold; the filtrate shaken two or three times with ether; the ethereal solution distilled, and the residue, after being evaporated to a certain extent over the water bath, is introduced into a retort and distilled over an open fire. The first portion of the distillate is watery and contains volatile acids; but afterward an oily liquid passes over, which soon solidifies in radiating crystals. The product may be freed from adhering volatile acids by dissolving it in a small quantity of warm water, supersaturating with baryta water, and again agitating with ether. On removing the ether by distillation, there remains a sirupy liquid which soon crystallizes, and may be further purified by redistillation. Resorcin is very soluble in water, alcohol, and ether, insoluble in sulphide of carbon and in chloroform. It crystallizes only from very concentrated solutions, in tabular crystals or short thick prisms. When first prepared it is quite colorless, but acquires a faint reddish tint by keeping or by exposure to the air.

(62) P. R. asks: What will cure cancer in a child's mouth? A. We believe your trouble is *cancrum oris*. It occurs in children of debilitated habits, between the ages of two years and five. "The symptoms are generally these: The child is out of health and evidently weak, and on one cheek is a hard indolent swelling. On examining the cavity of the mouth, a whitish or ash-colored eschar is seen in the center of the cheek, which gradually increases until the slough has spread over the whole of the interior of the cheek, lips, and gums. The saliva is copious, and horribly fetid. There is great constitutional disturbance; pulmonary complications are very apt to arise and the disease frequently ends fatally. The treatment consists in the application of the nitrate of silver to the slough, in frequently syringing the mouth with solutions of chloride of zinc or chlorinated soda, and in the free administration of strong beef tea, wine, or brandy, and chlorate of potassa in decoction of bark."—*Tanner*.

(63) H. L. S. asks: How can I find the most favorable spot for an artesian well? A. The only way in which a question of this kind can be settled with certainty is by boring. We do not know of any reliable work that teaches how this practical method can be avoided.

(64) A. E. P. asks: Is the pressure on a dam increased by the amount of flow back from the dam, or is it increased only by the perpendicular hight of the water? I claim that it makes no difference as to the amount of flow or water stored, but a friend thinks it does. A. You are right, as we understand your question.

(65) F. M. J. asks: 1. If a flue in an upright tubular boiler springs a leak under water, and we plug both ends with the flue in the boiler, is there any danger of the plugs boiling out? A. Yes, unless they are secured by a bolt passing through the tube. 2. Is the pressure in the flue greater than that in the boiler? A. No.

(66) G. C. says: We have an engine 8 x 16 inches, carrying 60 lbs. pressure. How fast should we run it for economy? A. At from 140 to 150 revolutions per minute.

(67) E. L. asks. 1. How can I draw a normal to an ellipse, from a point located outside of the ellipse? A. Draw straight lines from the point to the foci of the ellipse. The line bisecting the angle, so formed at the given point, will be the normal. You will find the properties of ellipses explained in any good treatise on conic sections.

(68) G. W. M. says: 1. I have a boat, 18 feet long and of 6 feet beam, with a propeller of 14 inches diameter. Can I run the boat with an engine 3 x 3½ inches, and a boiler 30 inches long and 24 wide? A. The propeller is rather too small. 2. What size of steam pipe should I have? A. Steam pipe ¾ to 1 inch in diameter. 3. How fast can I expect to run her? A. You may realize a speed of 5 miles an hour.

(69) J. T. asks: 1. What is the difference between a high and a low pressure engine? A. One has a condenser, and the other exhausts into the air. 2. Why will a low pressure boiler, carrying 40 lbs. steam, run a boat as well as a high pressure one carrying 130 lbs. steam? A. You must be mistaken in your statement. Can you verify it?

(70) W. H. says: I wish to construct a water engine to run a screw-cutting lathe of 9 inches swing and 4 feet bed. Our hydrant water has a force of 64 lbs. per square inch. I have been informed that one could be constructed similar to a steam engine, but with enlarged ports. Is this so? A. A wheel would make a more efficient engine. There are numerous forms of water engines in the market, and it would be well for you to address their manufacturers.

(71) J. H. K. says: I have been running an engine and boiler for 7 years; the boiler is tubular, and I find that, where the steam goes direct from the steam chest into the heater, there is an incrustation on the lower part of the boiler over the furnace, of 1½ to 2 inches in thickness. The boiler became cracked in two places, and commenced leaking. I then took out the boiler, examined it closely, and found that the flues of the boiler were entirely surrounded or covered with a lime sediment. Can you recommend any thing to put into the water to prevent the accumulation of any further incrustation in the boiler, and to take off the present sediment from the flues? A. We would recommend you to blow off some of the water, at least once a day, and about once a month clean the boiler, letting the water run out, twelve or twenty-four hours after the fire is hauled.

(72) J. J. R. says: I have an ordinary furnace in the basement of a 3-story house. The furnace has a sheet iron cover, which becomes hot and radiates in the cellar. Could I check the radiation by blanketing the cover with asbestos or other felting? A. Yes.

(73) J. A. says: Three plain cylinder boilers, side by side, were 30 inches in diameter and 40 feet long, with a 3 inch water connection at the bottom, and a steam drum on top, 8 feet long and 20 inches in diameter, with a connection with each boiler. There was a safety valve in center of drum, 8 inches above the top of the drum. They were filled up to the safety valve, and then the pressure was put on up to 85 lbs. on the inch. One joint leaked so that we had to make it afresh; it was under the safety valve casting; after taking off the weight, the engineer said that two or three barrels of water ran out of the valve, and the valve was the highest point of the boilers. I verified this myself. Can you explain this? A. From your description it seems probable that, while the boilers were being tested, they were stretched or distorted considerably, so as to have greater volume, and that, when the pressure was relieved by raising the safety valve, the boilers contracted and the water poured out at the highest point. We have frequently called attention to the ill effects likely to arise from the cold test, and always recommend that the boiler be filled with water and gradually heated.

(74) R. E. H. says: If a lever be placed with one end on a solid block, the other on scales, and a weight be suspended from center of lever will not the weight have more effect on the scales if I move it nearer to them, and less if I move it the other way? A. Yes.

(75) J. W. O. asks: Several of my friends say that the closer a horse (or any other animal) is to his load, the easier it is to pull, and *vice versâ*. I cannot see why the draft increases with the distance, except by the additional weight of chain or rope, and friction on the ground, if it touches the ground. A. You have the right idea.

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(76) F. E. K. says: We have two new boilers that have never been tested. Their dimensions are: Length, 22 feet, diameter 44 inches, thickness of shell ⅜, of heads ¼ inch, with two 16 inch flues. The heads are stayed with 5 stay rods and 20 stay bolts. They are built of C. H. No. 1 iron. There is one 4 inch safety valve for the two boilers. What is the greatest pressure at which it would be safe to run them? A. From 59 to 60 lbs.

(77) H. K. says, in reply to I. F. F., who asked which is the deepest well in the world: I believe the well at the St. Louis county insane asylum is, being 3,837 feet deep. At the depth of 3,545 feet the thermometer stood at 115° Fah.

(78) J. R. F. says, in reply to J. J., who asked how much the outside horse will gain in plowing a circular field, beginning at the center: Let d=distance between horses, r=radius of circle plowed by inside horse, and n=number of times they plow around. Then, while the inside horse is plowing around a circle with a radius, r, the outside horse is plowing round a circle with a radius $r+d$, and the distances traveled by each respectively are $r2\tau$ and $(r+d)2\tau$, and the difference is $d2\pi$. The total difference, for n times around, is $nd2\tau$. The inside horse in the second time around travels in the track of the outside horse the first time, and so on for each succeeding time until the last time around, when the outside horse makes a track of the radius $r+nd$, which the inside horse does not travel; neither does the outside horse travel in the track of the radius r, made by the inside horse in the first time around. Hence the difference in the distance traveled is $(r+nd)2\pi-r=2\pi=nd2\pi$, the same as above. This, it will be observed, is simply the difference between the distance which the inside horse travels the first time around and that which the outside horse travels the last time around.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

H. A. W.—We do not think that you would succeed in the artificial production of the mineral, even if you had the exact composition. Send us a specimen, and we will examine it for you.—C. J. J.—Send us a sample of the tin powder used in electrotypy.—W. C. S.—They are scales of decomposed mica with oxide of iron.—Rev. J. McC.—The bolt does not appear to be well made, nor of superior iron.—L. L.—It is black oxide of manganese, containing copper.—J. M. G.—It contains silex, alumina, oxide of iron, and carbonate of soda, carbonate of lime, and carbonate of magnesia.—W. M. T.—It is sulphide of iron.—E. P. C.—It is iron pyrites.—W. W. J.—It is difficult to say, without making a lengthy chemical analysis, why you cannot harden your steel.—J. W. F.—It is white iron pyrites.—F. W. B.—It is a coating of oxide of zinc. It does not injure the zinc, but rather tends to protect it from further action. If you desire, you can coat the interior of the refrigerator with paraffin.—W. B.—They are well crystallized sulphate of lime or gypsum. They are sometimes found 10 times as large as those sent, and as limpid as pure water. Have you found any such?—R. D. B.—We are unable to account for the scaling. The metal appears tough, close grained, and bright as though it had been rolled cold.—J. W. F.—No. 1 is red oxide of iron, with silicate of alumina. No. 2 is silex with black oxide of iron.—W. T. C.—No. 1 is the sulphate of baryta. No. 2: The powdered mineral contains the carbonates of lime, magnesia, and iron, with some silicates of alumina and silex.—J. E. L.—We did not detect arsenic.—T. S. L. G.—We could not detect gold in specimen sent. It was mostly iron pyrites.

J. B. F. asks: What horse power does it take to run a 3 foot corn burr and sheller?—W. E. T. asks: How can bear grass be prepared for market?—E. P. W. asks: What is a cheap material for small balloons, from 1 foot to 10 feet in diameter? Could tissue paper be made to answer by covering it with balloon varnish or some other preparation?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Remarkable Cloud. By J. P. N.
On Sunday at the Centennial. By J. E. F.
On the Imponderables. By W. T. Q.
On Sugar. By ——.

Also inquiries and answers from the following:

J. McM.—G. W. W.—L. S. W.—P. F. S.—A. B. L.—R. J. McC.—B. B.—L. C. C.—T. C.—J. B. S.—A. McG.—H. B.—C. L.—A. L. S.—J. H.—B. H.—C. W.—J. H.—J. B.—T. G.—P. H. J.—R. C.—B. W. J.—D. J. S.—H. M. H.—J. M. H.—J. E. B.—H. D. W.—B. A. J.—B. H. P.—F.—B. H. C.—S. N. M.—U. V. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes distilling apparatus? Who makes flax-cleaning machinery? Who makes an electricity-lighted student's lamp? Who publishes engravings of low pressure beam engines? Who sells the best tin roofing plates?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. **Almost any desired information can in this way be expeditiously obtained.**

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending,

April 25, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city

Addressing machine, J. M. Burkert ... 176,424
Advertising card, R. F. Baldwin ... 176,418
Auger for boring rock, G. J. Best ... 176,505
Awl haft, J. P. Curtiss ... 176,462
Axle thimble skein, C. Slonaker ... 176,490
Bag filler and measurer, J. J. Scholfield ... 176,555
Baggage check, J. E. Sullivan ... 176,493
Bale ties, G. S. France ... 176,613, 176,614
Barrel pitting, J. Bradley ... 176,587
Basin or sink plug, wash, F. J. Ordway ... 176,674
Bedstead, invalid, A. McArthur ... 176,540
Belt tightener, F. D. Green ... 176,624
Binder, temporary, T. J. Crichton ... 176,516
Binder, temporary, W. B. Rose, Jr ... 176,690
Blind slat holder, J. Belcher ... 176,581
Boats, fender for life, R. R. Wilkinson ... 176,723
Boiler, agricultural, H. L. Humphrey *et al* ... 176,534
Boiler feed water heater, etc., F. W. Keys ... 176,538
Boiler, hot water, A. Nimmo ... 176,441
Boiler, wash, M. Balue ... 176,576
Boilers, feed pump for steam, J. Armstrong ... 176,417
Books, construction of, H. R. Heyl ... 176,632
Boot and shoe heel, C. Schwerdtfeger ... 176,488
Boot heel stiffeners, forming, D. Scrymgeour ... 176,556
Bottle cover, E. K. Gooley ... 176,599
Boxes, manufacture of, S. Bingham ... 176,420
Bread, making, A. P. Zarin ... 176,502
Brick machine, Wilson *et al* (r) ... 7,076
Broiler, F. O. Badger ... 176,575
Brush, P. H. Raiford ... 176,682
Buckle, W. L. Braddock ... 176,589
Buckle, Steinbach & Zwanziger ... 176,702
Button, S. E. Mallett ... 176,436
Camera, outlining, T. S. Fellows ... 176,464
Camera stand tripod head, A. J. Russell ... 176,692
Can, safety filling, E. H. Covel ... 176,600
Capstan and windlass, P. C. St. Marie ... 176,561
Car axle box packing, I. Benedict ... 176,582
Car axle grease box, G. W. Shields ... 176,699
Car coupling, F. Jacob ... 176,638
Car coupling, J. J. Lahave ... 176,647
Car coupling, Langley *et al* ... 176,649
Car coupling, E. Russell (r) ... 7,082
Car coupling, J. Wagner ... 176,715
Car, refrigerator, L. B. Woolfolk ... 176,727
Car starter, G. R. Moore ... 176,542
Car surface condenser, W. R. Rowan ... 176,483
Carpet beater, C. W. Hamilton ... 176,469
Carriage stay end die, W. S. Ward ... 176,718
Cart, coal, J. S. Sible ... 176,700
Castings, scrap metal for, A. M. Ross ... 176,689
Chair, barber's, T. Noonan ... 176,672
Chair seat, W. Schnabel ... 176,486
Chair, tilting, M. V. Lunger ... 176,654
Churn, E. C. Blasdel ... 176,584
Churn, H. B. Ramsey ... 176,551
Churn, power, W. Vanurder ... 176,713
Cigar pouch, C. Bondy ... 176,457
Clothes dryer, E. Stillwell ... 176,708
Coffin attachment, S. A. Hughes ... 176,533
Commode, child's, A. B. Crowell ... 176,517
Cooker, steam, C. Elmore ... 176,524
Cooler or warmer, milk, Bunnell *et al* ... 176,592
Cork extractor, A. Miller ... 176,664
Corset, A. Wilson ... 176,499
Cot, fever, G. W. Kibbee ... 176,472
Cotton cleaner, McCauley *et al* (r) ... 7,074
Cotton gin feeder, T. C. Craven ... 176,601
Coupon cutter, S. M. Schafer ... 176,553
Cultivator, J. L. McCulloch ... 176,438
Cultivator, F. W. Stossberg ... 176,704
Cultivator and subsoiler, A. G. W. Foster ... 176,466
Curtain fixtures, E. M. Judd ... 176,537
Curtain fixtures, E. B. Lake ... 176,434
Dental drill, A. W. Todd ... 176,710
Deodorizer, J. Bradley ... 176,585
Digger, potato, J. W. Young ... 176,572
Dish cleaner, Chappell & Mayfield ... 176,510
Ditching machine, Johnson & West ... 176,640
Door check, J. Collins ... 176,598
Dress goods, exhibiting, L. H. Springer ... 176,559
Drill, ratchet, J. Renshaw ... 176,683
Drying apparatus, Harrison & Savery ... 176,628
Eggs, preserving, J. P. Whitlow ... 176,720
Engine governors, marine, Sangster *et al*., 176,484, 176,485
Engine, rotary, J. M. Gardner ... 176,616
Engine, rotary, T. C. Orr ... 176,545
Engine, rotary, J. R. Peters ... 176,547
Engine slide valves, setting out, W. Cooper ... 176,461
Envelope, E. W. Thomas ... 176,451
Eyelet stock, S. W. Young ... 176,501
Fabrics, making woven, D. Bailey ... 176,503
Fan, automatic, E. Dornheim ... 176,521
Fan, automatic, Gollner & Fretz ... 176,526
Fare box, I. S. Ferris ... 176,480
Fare register, G. Beadle ... 176,419
Fare register, E. Chesterman ... 176,426
Fence, A. P. Gaines ... 176,615
Fence post metallic socket, W. M. Phelps ... 176,519
Fence wire, barbed, R Emerson ... 176,523
Fence wire, barbed, P. Wineman ... 176,725
Fender, G. M. Peters ... 176,443
Fertilizer, desiccator, H. P. Lissagaray ... 176,474
Filter, J. W. Lefferts ... 176,651
Filter and cleaning filters, H. Williams ... 176,571
Filter, water, H. J. Burke ... 176,593
Fire arm, revolving, Smith & Marshall ... 176,448
Fire extinguisher, T. H. Dunham ... 176,608
Fire kindler, J. F. McCarty ... 176,661
Fire kindler, J. B. Sweetland ... 176,705
Fork, horse hay, D. S. Chaffin ... 176,509
Fountain, Hornbake & Wilkins ... 176,635
Fruit dryer, H. Stutzman ... 176,492
Furnace, etc., smoke-consuming, K. M. Jarvis ... 176,639
Furnace, steam house, D. B. Brown ... 176,508
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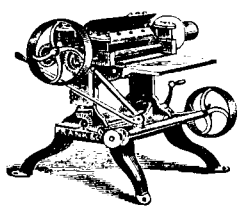

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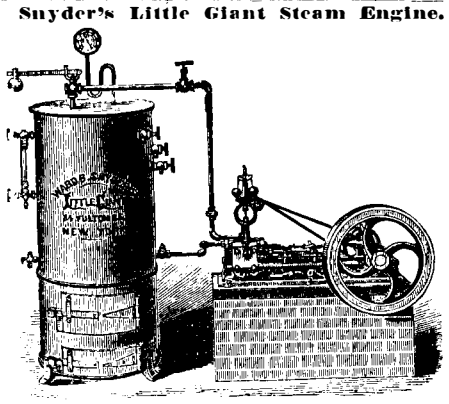

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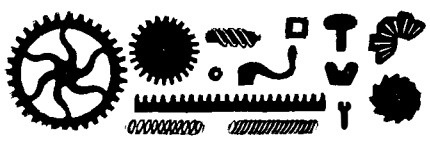

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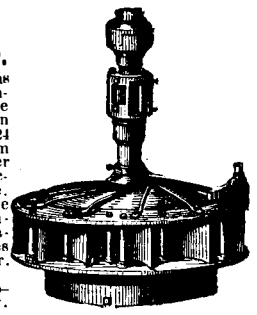

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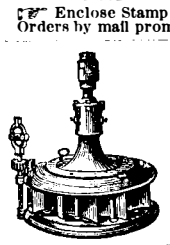

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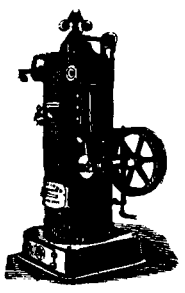

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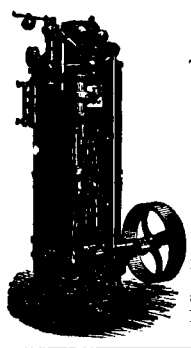

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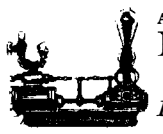

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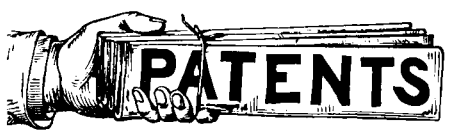

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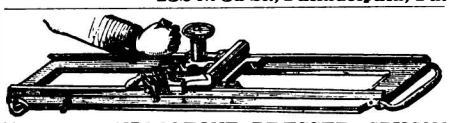

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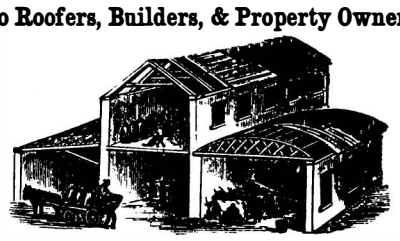

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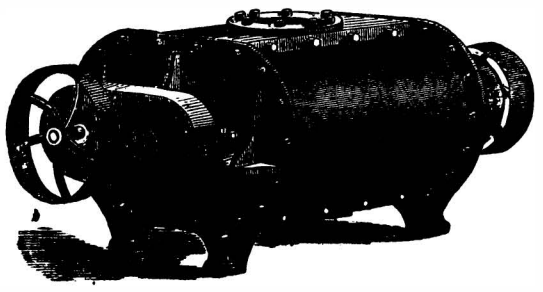

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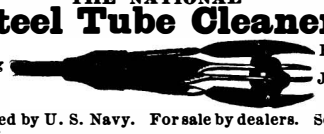

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